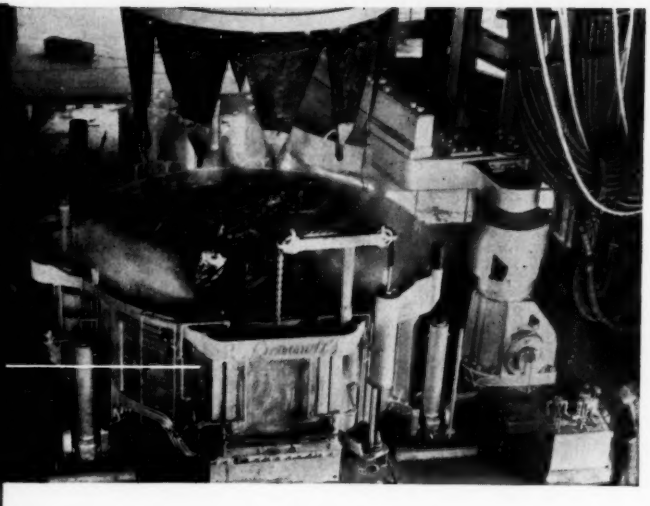
American Foundryman

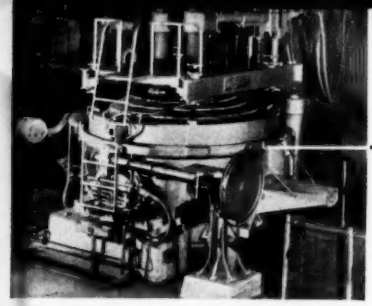
THE FOUNDRYMEN'S OWN MAGAZINE

September 1951

if you need 'em

BIG





...if you need 'em little

LECTROMELT Builds Furnaces up to 150-ton Capacity

ALL WITH LABOR-SAVING, TOP-CHARGING DESIGN . . .

No matter what the size of your heats, Lectromelt builds a furnace to handle it—up to 150-ton heat capacity.

Lectromelt* furnaces are top-charging design, giving you tremendous man power savings. Says one foundry superintendent, "I'd need labor at 40c an hour if we didn't have top charging on our furnace."

Lectromelt furnaces offer you all these additional moneysaving advantages; engineered and correlated electric power system; counterbalanced electrode arms; oil-bearing-mounted top structure; side-mounted tilting mechanism.

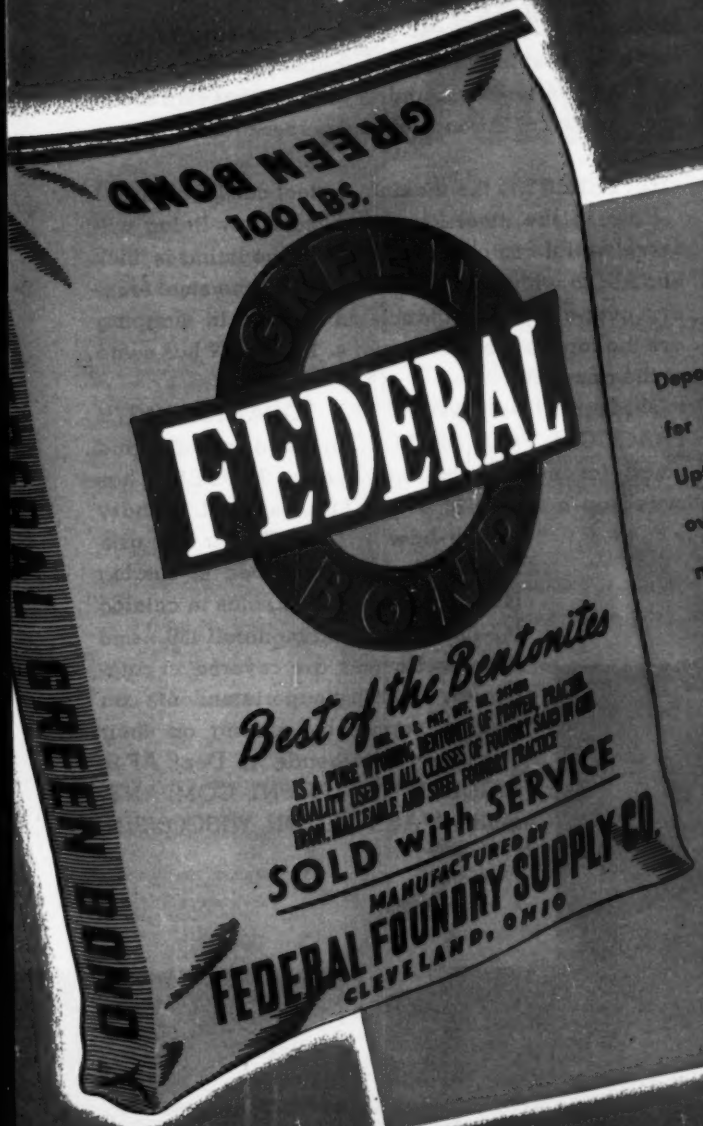
We'd be glad to talk over your melting, refining, smelting and reduction problems. Just write Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . SWEDEN: Birlec, Elektkougnar A/B, Stockholm . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Brassoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa.

*REG. T. M. U. S. PAT. OFF.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

STILL THE *Best* OF THE BENTONITES!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100 LBS.
FEDERAL
GREEN BOND
Best of the Bentonites
IS A PURE WYOMING BENTONITE OF PROPER PLASTIC QUALITY USED IN ALL CLASSES OF FOUNDRY SAND IN GRAY IRON, MALLEABLE AND STEEL FOUNDRY PRACTICE
SOLD with SERVICE
MANUFACTURED BY
FEDERAL FOUNDRY SUPPLY CO.
CLEVELAND, OHIO
FEDERAL GREEN BOND

Deposits of the finest Bentonite clay for foundry use are located near Upton, Wyoming. Here, on Federal-owned property, GREEN BOND is mined, dried and pulverized, to produce bonding clay of the finest quality and uniformity. From the very beginning, GREEN BOND has been the best of the Bentonites!

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A 3" POT FOR BRASS...
and this 6-Ton Bottom Pour for Steel..

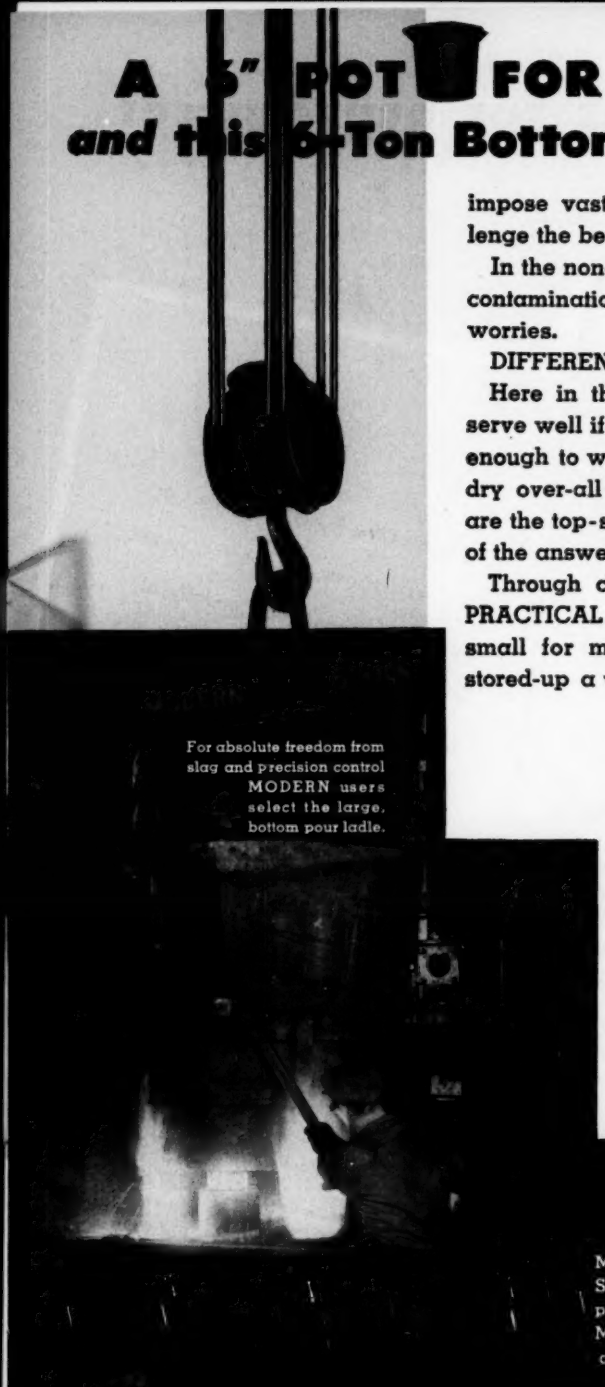
impose vastly different pouring problems to challenge the best in specialized, foundry engineering...

In the non-ferrous foundry, lining to prevent metal contamination is one of the superintendent's top worries.

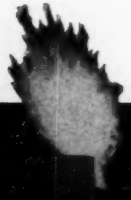
DIFFERENT is the making of steel castings.

Here in the steel foundry almost any lining will serve well if contour is right and if the lining is thick enough to withstand the heat. BUT in the steel foundry over-all ladle balance and speed in slagging are the top-spot considerations. MODERN has some of the answers:

Through closely WORKING TOGETHER WITH PRACTICAL FOUNDRYMEN, in foundries large and small for more than thirty years, MODERN has stored-up a wealth of over-all professional, foundry "know-how!" It's FREE for the asking: Ladles are described in catalog 149...chargers and cupolas in catalog 147-A...cranes and monorail 150...and Pouring Devices are covered in catalog 147. Foundry superintendents can reserve copies by writing on their company letterheads to Dept. AF-9, MODERN EQUIPMENT COMPANY, PORT WASHINGTON, WISCONSIN.



For absolute freedom from slag and precision control MODERN users select the large, bottom pour ladle.



Modern 58" bottom pour ladle at Maynard Electric Steel Casting Company, Milwaukee, is helping to pour 100 tons of steel in a 'round-the-clock operation. Molds poured here take from 2000 to 12,000 pounds of steel, each, for excavator carbodies.

MODERN EQUIPMENT CO.
PORT WASHINGTON, WISCONSIN

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ABC

SEPTEMBER, 1951

VOLUME XX, NUMBER 3

American Foundryman

September, 1951

Official publication of American Foundrymen's Society

Editorial — Regulation Increases Need for Knowing Costs: R. L. Lee.

Rigid Controls and Standards Improve Duplexing Operation: Fitz Coghlin, Jr.

Launch Safety & Hygiene & Air Pollution Program for Foundries.

Dropping the Cupola Bottom: James Timbrell.

Controls for Green Working Strength of Molding Sands: Harry W. Dietert.

1952 International Foundry Congress.

Modern Foundry Methods—Unusual Equipment Employed to Make Centrifugally Cast Brake Drums.

A Review of 1951 A.F.S. Apprentice Contest Entries: Roy W. Schroeder.

Four Regionals in October.

Mg-Zr Casting Alloys Attain High Strength-Weight Ratios: H. J. Millward.

Safe Practices in School Foundries: L. M. Merritt and D. C. Williams.

Basic Refractories and Slags for Electric Steel Furnaces: A. H. Thomson.

Some Experiments in Preparing Nodular Iron: W. P. Fishel and Robert C. Bramlette.

The Saugus Pot—an American Legend is Authenticated.

Foundry Personalities.

New A.F.S. Members.

Chapter Activities News.

Abstracts of Technical Articles.

Foundry Firm Facts.

Advertisers' Index.

A.F.S. Employment Service.

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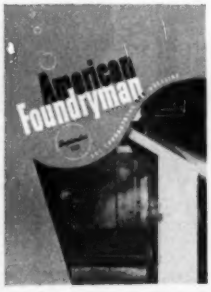


Air becomes cleaner inside and outside of foundries as more and more exhaust systems—such as this ventilated shakeout—are installed or enlarged, as better dust and fume collecting and disposal units are developed, and as the whole field of foundry safety, hygiene and air pollution receives greater attention from the foundry industry. The unit illustrated on the front cover keeps air in the vicinity of the mechanical shakeout clean without interfering with the crane sling and shakeout operations.

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subcription price in the U. S., Canada and Mexico, $3.00 per year; elsewhere, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois. EASTERN REPRESENTATIVE—C. A. Larson & Associates, 24 West 51st St., New York 1, N. Y. CENTRAL REPRESENTATIVE—R. E. Cleary, Commercial & Savings Bank Bldg., Berea, Ohio. MIDWESTERN—H. Thorpe Covington Co., 677 N. Michigan Ave., Chicago, Ill.

SPEED UP GATE REMOVAL with DoALL FRICTION SAWING!

THE speed of DoALL Zephyr Band Machines for removing gates, risers, flash and other superfluous material from castings will surprise you. DoALL Zephyr Band Machines are fast: they have actually saved as much as 90% in time and tool costs, depending on the thickness of the work. With DoALL you are able to get into complicated spaces and cut *close* to the casting and as finish is generally of high quality, grinding can be either eliminated or materially reduced. The cut is made fast enough so as not to allow heat penetration into the side wall of the finished cut and skin hardness never exceeds .003" deep. Zephyr Friction Sawing means low tool cost and greater tool safety for the operator.

Where extremely fine tolerance and optimum efficiency is desired, automatic hydraulic feeding tables are available. There is a size DoALL Zephyr for every pocketbook and for almost every problem. If you have a special problem we will cooperate with you in tailoring saw design to solve it. Here are advantages you should look into. Ask for a free demonstration in your own plant. Call our local DoALL Sales Service Store or write.

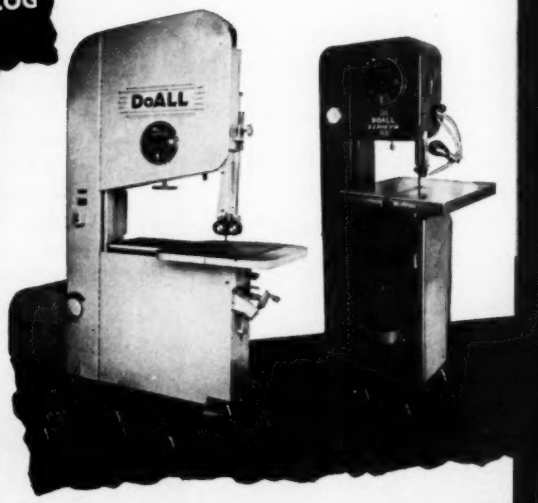
THE DoALL COMPANY, 254 N. Laurel Ave., Des Plaines, Ill.

Above: **Here is a DoALL Zephyr in a typical installation removing dead metal.**

Below: **With DoALL Friction Sawing you can cut close to the live metal and reach the hard-to-get-at places.**

SEND FOR CATALOG

There is quite a story on costs and speeds in handling castings of various thicknesses. Ask for complete details with a catalog on DoALL Modern Band Machines.



BMF-1

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Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies

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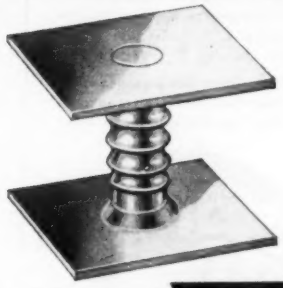


. . . insure maximum fusion resulting in sounder castings

The pictures below graphically show why. They visualize the findings of studies conducted by Batelle Memorial Institute of Columbus, supplemented by field tests in leading foundries. And more and more companies doing critical casting work are standardizing on this new chaplet because of its all around superiority.

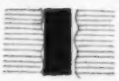
COUNTERSUNK SHOULDERS ELIMINATE GAS POCKETS

Sharp, right angle shoulders of conventional type of chaplet form large gas pockets.

Raised shoulder of this type reinforces but tends to form small gas pockets.

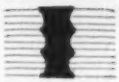
Fanner Countersunk shoulder has a taper design which reinforces head and eliminates gas pockets.

FEATHEREDGE FUSION RINGS ELIMINATE LEAKERS



Rolling metal does not seal against straight side of conventional stem; small pockets remain.

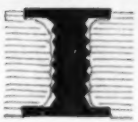
Deformed stem offers better sealing surface for metal, but some voids may be created on inside of radii.



Knife-like edges of fusion rings heat instantly, fuse completely, eliminate leakers.

RADIUS GROOVES EFFECT MAXIMUM FUSION

Conventional chaplet fails to fuse completely both along stem and at shoulders.



Threaded stem creates gas pockets at base of threads.

Rounded grooves of Fanner chaplet permit metal to "lay up" close to stem and effect maximum contact and fusion.

Groovestem Chaplets either tin or copper coated are available in Motor, Button Head, and Double Head types. They are stocked in substantial quantities to give you the fastest possible service. Order today.

FANNER MFG. CO., CLEVELAND 1, OHIO

In Canada: CANADIAN FANNER, LTD., Hamilton, Ont., Canada

Lighter . . . faster Rotor grinders

"PAID OFF" in 48 days

JOB: Grinding welds on truck cabs. Using slow, 20-pound electric grinders. Only 2800 r.p.m. under load.

SOLUTION: Rotor Application Engineer suggested changing to Rotor 6" Air Grinders that weigh only 9¾ pounds. Speed 5300 r.p.m. under load.

RESULTS: Stepped up metal removal, increased wheel life. Lower maintenance. Cut man-hours per cab. Savings "paid off" cost of Rotor Grinders in 48 days—on basis of 50% use factor.

Call in your Rotor Application Engineer for a study of your portable tool operations to suggest improvements. Write for Catalog No. 38.

AIR O'TOOL

ROTOR GRINDER FACTS

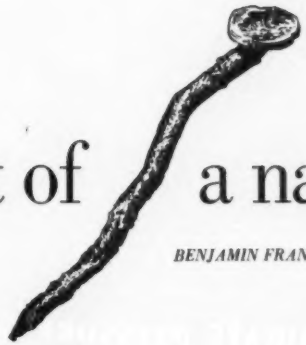
LIGHTER . . . Unique two-blade design and magnesium handles. Easy to move around. 6" Rotor Grinder weighs only 9¾ lbs. . . . 8" only 11¼ lbs.

FASTER . . . Rotor Grinders, known as the "Power Plus" line are recognized everywhere for their high speed *under load.*

AIR ROTOR TOOL HIGH CYCLE

"For the want of a nail the shoe was lost,
For the want of a shoe the horse was lost,
For the want of a horse the rider was lost,
For the want of a rider the battle was lost,
For the want of a battle the Kingdom was lost . . .

and all for want of a nail"



BENJAMIN FRANKLIN, "Poor Richard," 1758

The fate of nations often hangs on little things. Take this rusty old nail. It symbolizes thousands of tons of worn-out machines and broken parts lying useless in our plants, factories, farms, and homes—scrap steel desperately needed today by our steel mills.

You can help make this nail, and all the other scrap you can collect, go to work again . . . in new steel for ships, tanks, and guns required for defense purposes.

So survey your plant now for every last bit of scrap. Then get it to your scrap dealer promptly. This will not only help assure the nation of the arms needed to preserve our freedom, but it will also mean more steel for your own products tomorrow.

ELECTRO METALLURGICAL COMPANY, a Division of Union Carbide and Carbon Corporation.

is high man...

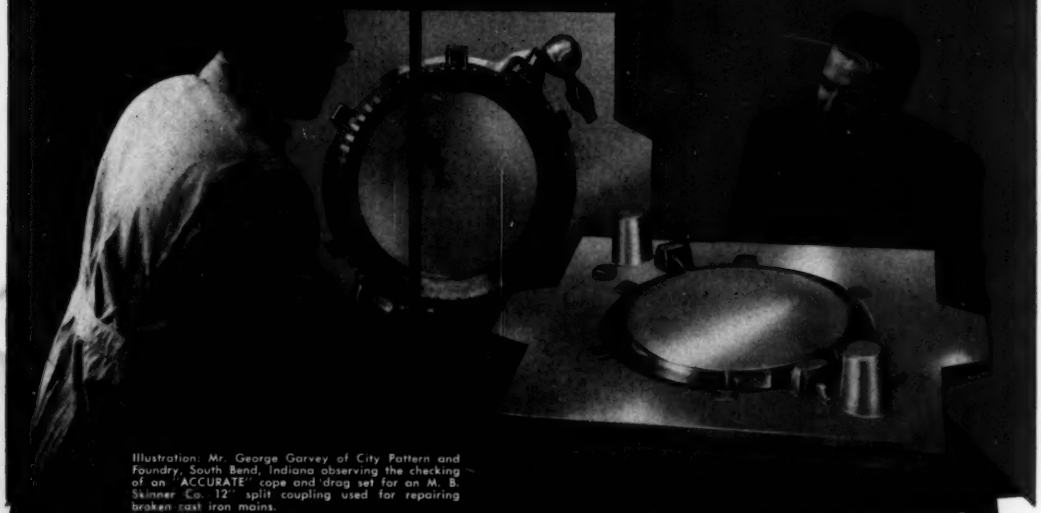


Illustration: Mr. George Garvey of City Pattern and Foundry, South Bend, Indiana observing the checking of an "ACCURATE" cope and drag set for an M. B. Skinner Co. 12" split coupling used for repairing broken cast iron mains.

WITH ACCURATE PRESSURE CAST COPE AND DRAG SETS

QUICK DELIVERY

By Air Freight, Parcel Post, Special Delivery or Railway Express. Pick-up and delivery by jobber representatives in the following areas:

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Foundries everywhere are looking for means to increase production and lower their costs. ACCURATE cope and drag sets have helped to solve this problem for hundreds of the leading foundries from coast to coast.

ACCURATE cope and drag sets have clean smooth partings and patterns as cast, are straightened, and have alignment points. This will substantially reduce your finishing costs.

Maximum over-all plate dimensions for cope and drag sets are 54" x 64" and 48" x 80".

Why not use this profit making idea in your foundry? Write for catalog No. 515.

ACCURATE MATCH PLATE COMPANY
1847 WEST CARROLL AVENUE CHICAGO 12, ILLINOIS
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Our Customers Know it's a Fact!

LEADING GRAY IRON FOUNDRIES AND MALLEABLE FOUNDRIES WITH CUPOLA OPERATION.

If you're not using Famous Cornell Cupola Flux you are paying many times its cost in Casting Rejects, Slower Machining and Cupola Maintenance.

Approx. 4 pound brick

Write for Bulletin No. 46-B

By thorough cleansing of molten iron, making it more fluid and reducing sulphur, Famous Cornell Cupola Flux greatly increases the percentage of sound, clean castings, and facilitates machining operations.

BUT THAT'S NOT ALL! Cupolas are kept cleaner and efficiency greatly increased. Down-time and maintenance cost is reduced amazingly.

Famous CORNELL CUPOLA FLUX

in Exclusive Scored Brick Form

Makes fluxing of molten iron fast, easy, and you can use the exact amount to do the job right — without waste. Simply lift Famous Cornell Cupola Flux from container and toss it into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

The CLEVELAND FLUX Co

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Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze Aluminum and Ladle Fluxes—Since 1918.

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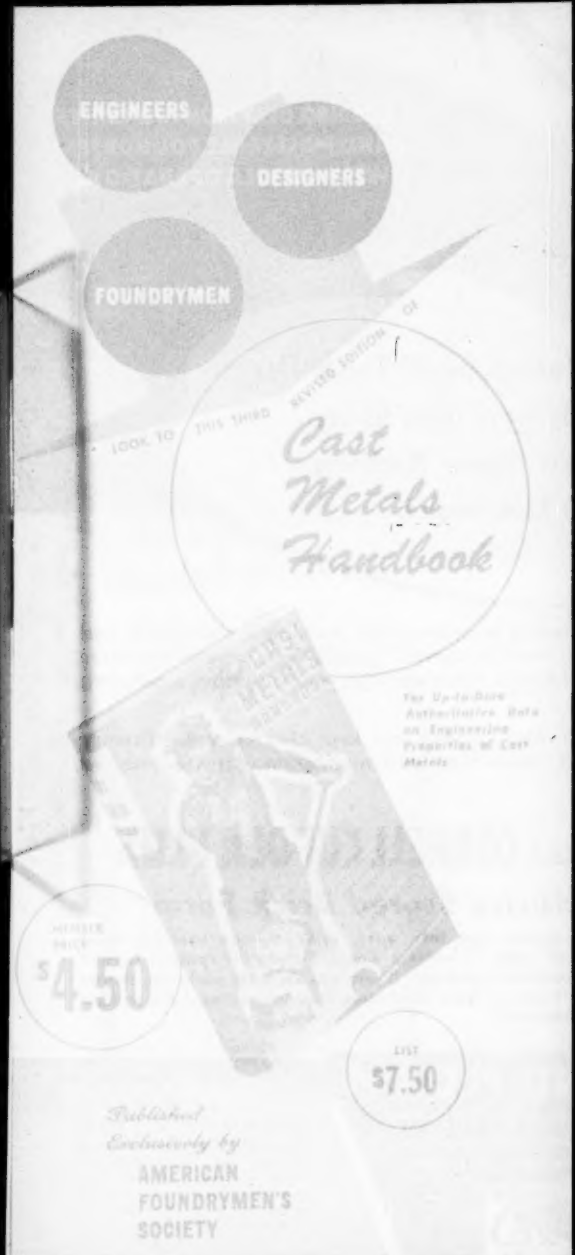
Trade Mark Registered

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

BOOK NUMBER		MEMBER PRICE	LIST PRICE
1	Alloy Cast Irons Handbook (2nd Edition)	$2.75	$ 4.50
2	Aluminum Foundry Process Control (SAE)	1.00	2.50
39	AFS Foundry Apprentice Course Outline	1.00	2.00

BOOKS.... TO MEET THE CURRENT NEEDS OF THE FOUNDRY INDUSTRY



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27	AFS "Transactions" Vol. 51, 1943	3.00	15.00
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45	AFS "Transactions" Vol. 58, 1950	8.00	15.00
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41	Non-Ferrous Melting Practice (AIME)	3.00	3.50
42	Risering of Gray Iron Castings, Research Report No. 1	2.00	4.00
43	Risering of Gray Iron Castings, Research Report No. 2	2.00	4.00
44	Graphite Classification Chart (25x38 in.)	1.25	1.75
46	Engineering Properties of Cast Iron	2.25	3.50
47	Sand Test Data for Production of Steel Castings	3.00	4.75

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1	2	3	4	6	7	8	9	10	11	12
13	14	15	16	18	19	20	21	22	23	24
25	26	27	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47

Name _____

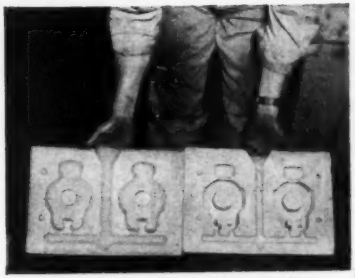
Address _____

City _____

Zone _____ State _____

Company _____

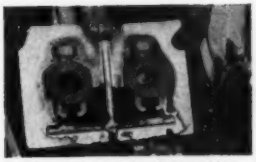
AFS pays postage when remittance accompanies order.



Resin bonded shell mold showing back (left) and face (right).

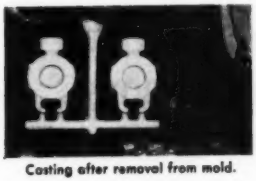
How to boost your production:

Use Monsanto Resinox resins with new shell molding process



Removal of casting from mold.

Not only does the Shell Molding ("C") Process help you speed up production, but it enables you to get castings with a superior finish . . . and castings with dimensional accuracy comparable to that achieved by precision casting techniques. And there are other advantages you will want to look into:



Casting after removal from mold.

1. Better metal yields (more castings per pound of metal poured)
2. Castings requiring little or no cleanup
3. Less sand handling
4. Excellent castings of intricate shapes and thin sections

Monsanto manufactures a wide range of Resinox phenolic resins research-built for the Shell Molding Process, and others already used by many foundries to improve cores, and reduce baking cycles up to 50%. *For more information about the new Shell Mold Process, and for data on Resinox for molds and core binding, please send the coupon below.* Resinox: Reg. U. S. Pat. Off.

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CHEMICALS — PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY, Plastics Division,
Room 5605, Springfield 2, Mass.

☐ Please send me your booklet, "The 'C' Process for Making Molds and Cores for Foundry Use."

☐ Please send me information on Resinox for _____

Name & Title _____

Company _____

Address _____

City, Zone, State _____

MEXICAN CORDIP®—ANOTHER NEW PRODUCT DEVELOPED BY THE UNITED STATES GRAPHITE COMPANY

NEW NON-FERMENTING WASH GIVES SMOOTHER, TRUER CASTINGS

Mexican Cordip is just one of the many new products that are continually being developed by the research facilities of The United States Graphite Company. Mexican Cordip is a high temperature coating that gives castings maximum surface smoothness. Dry or green cores maintain true dimensions because Mexican Cordip *will not build up or run on core surfaces.* It penetrates sand to an effective depth to prevent burn-in. Since its development in the laboratories, Mexican Cordip has proven its worth in daily use in some of America's finest foundries. Mexican Cordip is supplied in powdered form complete with binder and is *easy to prepare and use* either as a spray or dip. Also, Mexican Cordip is non-fermenting. There's no messy dip tank cleaning . . . no disagreeable odors.

Small cupola used to simulate actual pouring conditions at The United States Graphite Company laboratory.

1¼" cores with small cylindrical cavity being charged with metal (left) for insertion into the hot zone of the Dilatometer (right). Metal melts to form a small pellet. After cooling, the core and casting are studied for ease of removal, coating remaining, burn-in, and surface appearance.

MODERN LABORATORY DUPLICATES ACTUAL FOUNDRY CONDITIONS FOR BETTER PRODUCT RESEARCH

Old-time foundry men and newly graduated metallurgists alike who have visited The United States Graphite Company's neat, new foundry research laboratories in Saginaw have been enthusiastic about the completeness of the equipment, *the thoroughness of the tests*—and the extent to which the engineers here are going in order to develop even better Mexican Graphite products for America's foundries.

In this amazingly complete laboratory is a perfect little 4½" diameter cupola that exactly duplicates the results of its big brothers on production. An electric furnace and a Dilatometer are used to study the effect of temperatures up to 3000° F under just about any atmosphere. Metallurgical microscopes are used for closer study (up to 3,000 diameters) of the sand-metal interface of experimental cores and molds.

There is a core oven and complete sand testing equipment so that precise studies can be made of the penetration, effect on surface, and physical characteristic of sand when using various types of Mexican Graphite washes.

Within this modern laboratory there is even a chemical laboratory *fully equipped for making every kind of test and analysis* that is likely to apply to foundry products and foundry practice.

It is largely because of the completeness of this modern laboratory—and the skill, knowledge and creative ability of the engineers here that United States Graphite Company products are so effectively saving production time, cutting costs and helping to assure better castings in America's leading foundries today. *This laboratory is at your service.* Call or write us.

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

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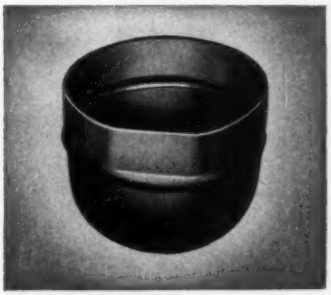
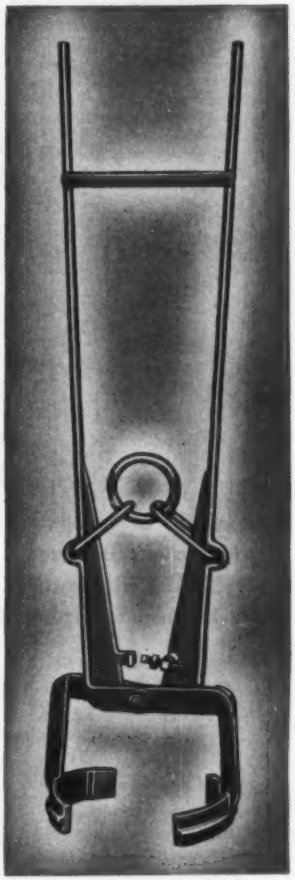
Bowls · Shanks · Tongs

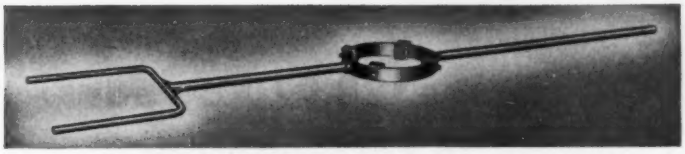


Industrial Equipment round bottom pressed steel ladle bowl, 50 lb. capacity, type 7 flat side.

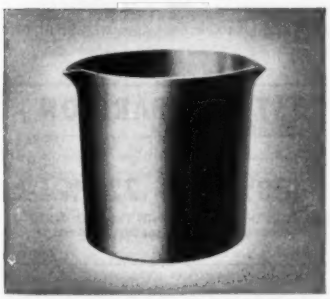
Industrial Equipment round bottom pressed steel ladle bowl, 60 lb. capacity, type 14 circular.



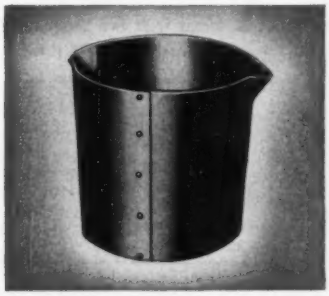
Type 72C crucible tongs. Adjustable. Four-point suspension. Claw types also available.



Industrial Equipment type 30CA single and adjustable ladle and crucible shank. Four-point suspension . . . easily adjustable . . . no springs . . . air cooled band. Fixed band types also available.



Industrial Equipment type 514 flat bottom welded steel ladle bowl. Available in almost any size or thickness.



Industrial Equipment 537 flat bottom riveted steel ladle bowl.

The above Industrial Equipment products, along with dozens of other types of bowls, shanks, tongs and ladles, are included in our latest catalog. *Write for your copy.*

LADLES

SHANKS

BOWLS

TONGS

Industrial

EQUIPMENT COMPANY

115 NORTH OHIO ST., MINSTER, OHIO

Saves $28,970 a year in core-baking

AT ONE PROGRESSIVE FOUNDRY* which replaced three conventional drying ovens with two THERMEX Core-baking Units, a cost comparison of old and new methods shows these results:

	COST COMPARISON	
LABOR FLOOR SPACE SAND & BINDERS UTILITIES MAINTENANCE REJECTS	100% WITH CONVENTIONAL OVENS	72.2% WITH THERMEX CORE-BAKING EQUIPMENT

This represents a saving of 27.8% for each 1000 pounds of finished cores. Based on the foundry's total production, *annual savings amount to $28,970. Thus the new THERMEX Core-baking Equipment will pay for itself in less than a year.*

Why not take advantage of this labor-saving, cost-cutting equipment? A THERMEX field engineer will be glad to show you engineering economy studies, based on installations like this, which give complete cost data. Write The Girdler Corporation, Thermex Division, Louisville 1, Kentucky.

*Name on request

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Partial list of companies who have purchased THERMEX Electronic Core-baking Equipment

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THE GIRDLER CORPORATION
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when you need CORE BOX PROTECTION ...it's MARTIN

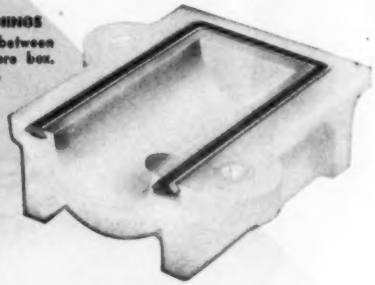
"PROTEXABOX PINS"
Cannot mar the box face because they will not loosen. Protective rubber tip guaranteed to stay on.

"SAND ARRESTER TUBE"
Save cores and step up production. Guaranteed for 100,000 blows.

Every Martin product is designed especially for "core box protection"—each is built to prevent a specific type of wear on your core boxes. They are engineered by foundry men to assure easy installation, successful operation. Martin products add years to the life of your equipment by enabling you to salvage old plates and core boxes, by preventing abrasion, and giving your plywood blow plates the lasting qualities of steel. Each product carries a guarantee of absolute satisfaction.

Martin products are manufactured under United States and foreign patents and distributed all over the world by foundry supply houses.

"HOLINER" BUSHINGS
Stop abrasion between blow plate and core box. Protect blow holes.



"STRIPINSERT"
Protects parting line—easily installed in old or new boxes. Cutters for groove available at moderate cost.

"PULLINSERT" BLOW BUTTONS
Positively stop sand blasting under blow holes. Available in nine popular sizes.

"VIBROLATOR"

The powerful all-directional vibration of the Peterson Vibrolator makes this an ideal unit for keeping materials flowing in chutes or hoppers. The Vibrolator will not crack attaching lugs on match plates or core boxes. Instantly self starting and virtually noiseless in operation, this new type vibrator eliminates maintenance worries and gives a long, dependable service life. No lubrication is necessary. The Vibrolator is light in weight to lessen fatigue and permit maximum delivery of vibration. There are five sizes available to meet all your foundry requirements. Peterson Vibrolators are sold only by Martin, exclusive manufacturers of ball-type vibrators.

"VIBROLATOR"

See your foundry distributor or write for folders describing these Martin products in detail. If you have a sand movement problem, send us complete information and our engineers will prescribe the correct vibrator for your needs.

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"NO MORE STOOL STICKERS ... SINCE WE STARTED USING NATIONAL TRADE-MARK GRAPHITE STOOL INSERTS!"

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for greater FOUNDRY efficiency...

Use AMERICAN CERAMIC STRAINER CORES

Now . . . you can be SURE of slag-free castings—save time and labor by using efficient, low-cost American Ceramic Strainer Cores.

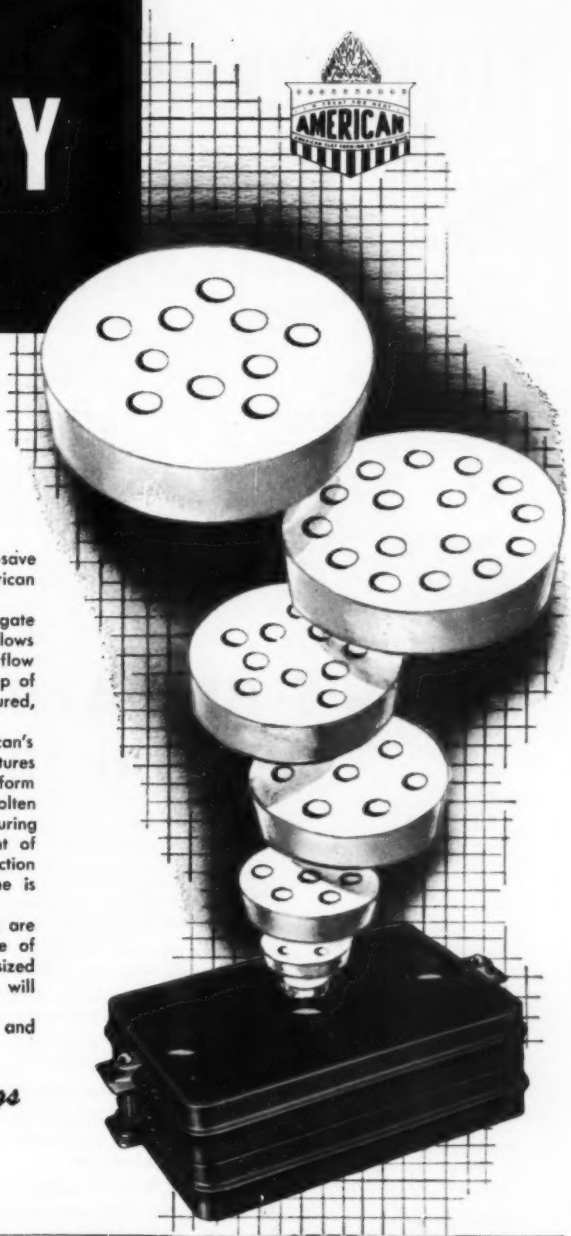
American's Ceramic Strainer Cores fit into the gate of the mold—they strain the molten metal as it flows through the holes of the strainer cores, making it flow smoothly into the mold. The slag remains on top of the strainer core and the result is an evenly poured, slag-free casting.

Machine made under high pressures, American's Ceramic Strainer Cores are fired to temperatures above 2400° F. They are very strong and uniform and are not effected by the heat shock of molten metal. The holes remain round and uniform during the pouring operation. Therefore, the per cent of rejected castings is held to a very minimum—production is increased and, of course, foundry labor time is definitely saved.

American's widely tested Ceramic Strainer Cores are available in eight sizes covering a wide range of requirements and are packed in convenient sized cartons for easy and quick handling. American will quote prices on special sized Ceramic Cores.

Write today for complete information, samples and the name of your nearest representative.

Assures Slag-Free Castings



A TREAT FOR HEAT
AMERICAN
AMERICAN CLAY FORMING CO. TIFFIN, OHIO

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MANUFACTURERS OF SPECIALIZED REFRACTORIES FOR OVER 30 YEARS
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DON'T BE PANICKED
BY METAL SHORTAGES!

Most foundrymen feel the rub of short supply at one time or another. Likely to feel it suddenly too, when someone's D.O. has forestalled the delivery ear-marked for you!

Waiting for the re-scheduled delivery is not the only solution.

Best of all, discuss your difficulty with a Federated salesman and let him ferret out an alloy which can be used in place of your regular metal.

Often, a substitution is found to be superior. Tenzaloy , for example, is being used on many jobs where the requirement of light weight and high strength has previously demanded laborious and expensive heat treatment, now unnecessary because of Tenzaloy's high as-cast strength.

Sometimes it's one of Federated's many alloys which the customer has never tested because he has been satisfied with what he had.

Sometimes it's a new alloy created by Federated for the customer's specific needs.

Whichever it is, Federated salesmen get the foundryman's problems in front of the laboratory staff and Federated's metallurgists find out which alloy the customer can use to his best advantage.

In any case, don't be panicked by shortages until you've asked the Federated salesman for the help that Federated can give on any foundry problem, large or small.

Federated Metals Division

Federated first in the non-ferrous field. FMD

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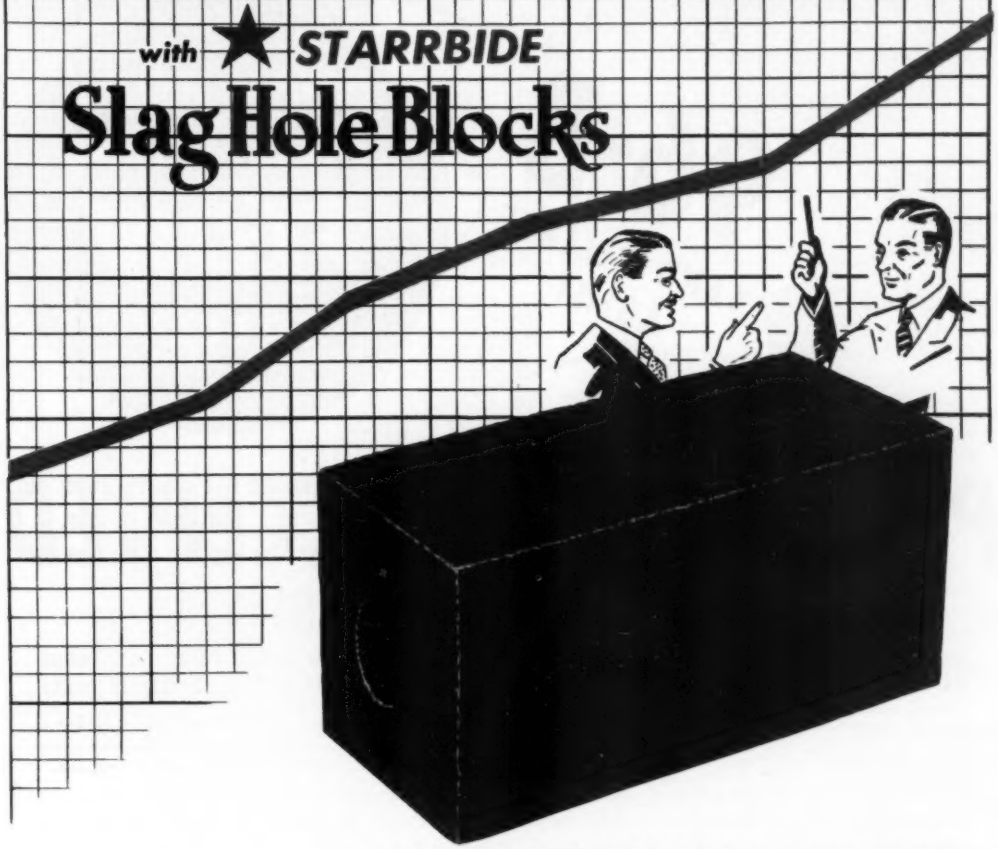
GREATER CUPOLA PRODUCTIVITY

with ★ STARRBIDE

Slag Hole Blocks



★ STARRBIDE ***Carbon-bonded*** slag hole blocks last longer than blocks bonded with any other material.

★ The absence of fusible materials, such as clay, plus the high thermal conductivity of STARRBIDE itself which rapidly dissipates heat at the slag hole, reduces erosion from heat and slag flow to a heretofore unheard of low.

★ STARRBIDE slag hole blocks afford better flow control and longer pouring runs for foundry cupolas — are, therefore, a "must" in foundries faced with high production schedules. Write for full details.

Also manufacturers of STARRBIDE carbon-bonded crucibles, graphite crucibles and super-refractories.

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Now.... DELTA

96-B SAND RELEASE AGENT

PREVENTS STICKING ...MAKES SAND FLOW FREELY

Another Foundry "First" by DELTA

HAS BEEN

PROVED AND ACCEPTED

BY LEADING FOUNDRIES

By adding only 8 ounces or less of DELTA 96-B SAND RELEASE AGENT, per ton, to your core or molding sand mixes, your sands will flow freely . . . be easier to handle . . . easier to use. They will not stick to core boxes or patterns no matter how intricate they may be.

DELTA 96-B SAND RELEASE AGENT is the result of persistent research by DELTA Laboratories devoted to the discovery and development of a lubricant-dispersant for use in sand mixes. DELTA 96-B is a liquid which provides properties hitherto unknown in sand conditioning materials. It is completely volatile at elevated temperatures and does not contaminate the sand.

Prove it yourself in your own foundry. Ask for a test sample. No cost or obligation. You will also receive instructions for use. Write today.

READ WHAT USERS SAY ABOUT DELTA 96-B SAND RELEASE AGENT

". . . . with the addition of 96-B we get improved core density and more uniformly-rammed mold hardness."

". . . . with the addition of 8 ozs. of Delta 96-B we are now able to blow cores we otherwise couldn't blow."

". . . . Delta 96-B gives the sand improved flowability. Our sand now works much more freely and leaves the core boxes clean."

". . . . and the trouble we had with sand sticking in the hoppers, in the chutes and on the conveyor has been eliminated with the use of Delta 96-B."

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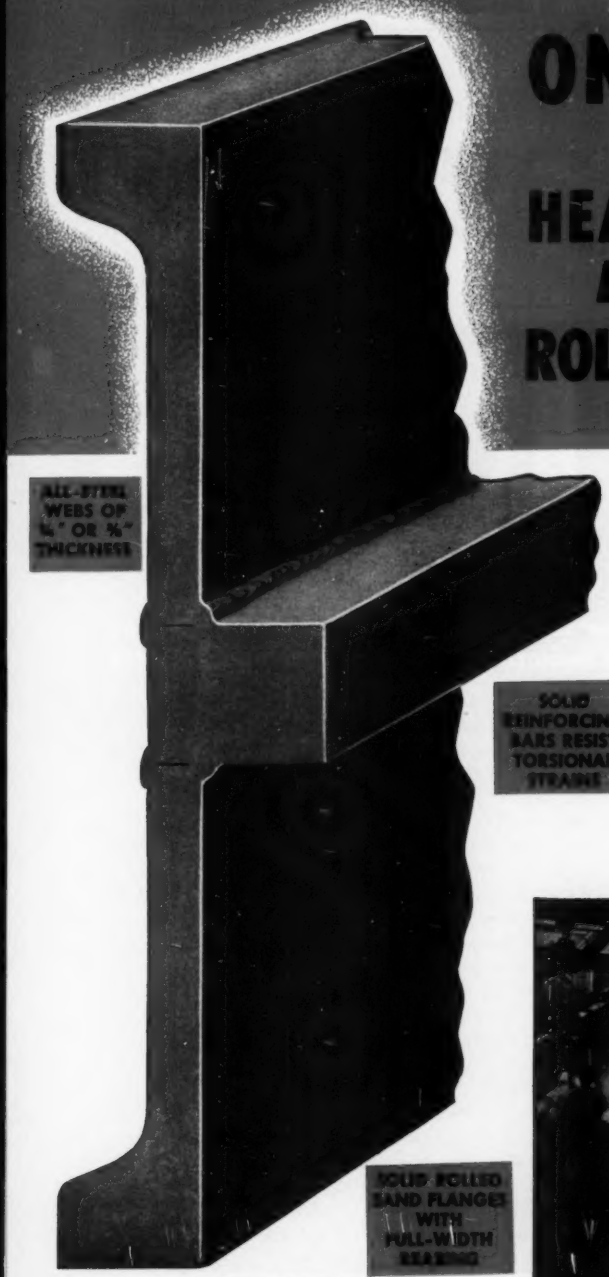
MORE THAN 4500 FOUNDRIES ARE USING STERLING FLASKS

ONLY STERLING
Gives You
HEAVY-DUTY FLASKS
Engineered from
ROLLED STEEL CHANNEL


ALL-STEEL WEBS OF ¼" OR ⅜" THICKNESS
SOLID REINFORCING BARS RESIST TORSIONAL STRAINS
SOLID ROLLED SAND FLANGES WITH FULL-WIDTH BEARING

UP AND DOWN THRUST — Sections retain the same height. Will not collapse after continual usage. Heavy sand flanges with full-width bearing. Cannot curl under jolt action.

Almost a Half Century of "Know-How" Assures Precision-Built Steel Flasks Fabricated to Highest Quality Standards

You can always rely on Sterling Heavy Duty Flasks because they are carefully fabricated from hot rolled steel of 70,000 lbs. tensile strength and copper bearing. Backed by almost a half century of experience in this specialized field. All-steel welded construction . . . solid reinforcing bars . . . heavy rolled steel flanges . . . square corners . . . full-width bearing. These are Sterling patented, life-prolonging features that assure rigidity and accuracy, even under constant production pressure. Sterling Flasks are available in a variety of styles and shapes to meet your needs. Write for Catalog No. 60A.

STERLING WHEELBARROW CO.
Milwaukee 14, Wisconsin, U. S. A.

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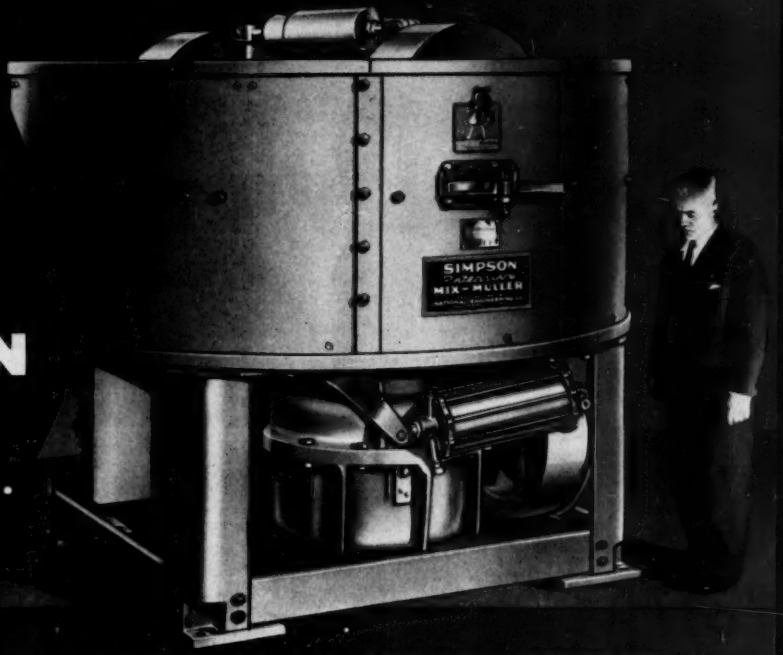
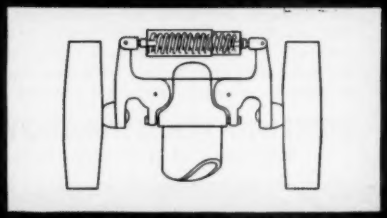


— a new concept of sand preparation backed by years of research and ON-THE-JOB PERFORMANCE



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SIMPSON
Intensive
MIX-MULLERS

REGULATION INCREASES NEED FOR KNOWING COSTS

PROMULGATION OF THE PRICE regulation on metal castings (CPR 60, issued July 31 by the Office of Price Stabilization and effective September 1) emphasizes the necessity for having an adequate foundry cost system. In addition to all the other oft-repeated reasons, a realistic cost system now is necessary as a guide in establishing the proper figures for formula pricing.

CPR 60 allows two methods of pricing. One is based on the foundryman's published price list as of January 25, 1951, corrected to account for increase or reduction in metal costs. The second is based on each foundryman's own formula and is the method that will be used most widely.

Elements in any formula include metal cost, labor cost, extras and service charges, and overhead and profit margin. Metal costs are determined directly from invoices. Profit margin is a matter of administrative and sales decision. Labor, overhead, extras, and service charges, are the formula elements controllable by proper cost methods.

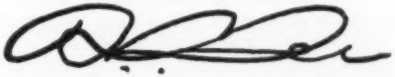
In times of ordinary competition, accurate and up-to-date values for these formula elements are essential if a foundry is to remain solvent and is to provide an adequate income for the people it supports. Inaccurate values, heavily weighted to compensate for ignorance of true costs, are unfair to the customer who will eventually seek other sources of supply or other methods of producing his products. Now, under government price regulations, simple, accurate costs information is even more necessary if not mandatory.

The various details which make up the broader elements of foundry cost—melting, molding, core clean- and finishing, miscellaneous, and the accounts common to all departments—were detailed some ten years ago in *Classification of Foundry Cost Factors,* a report of the A.F.S. Cost Committee. Membership of the committee was made up of representatives of the several Society divisions and of the other foundry organizations to give the recommendations the broadest possible application. Distribution of indirect costs is also considered in this report.

Foundry Cost Methods, giving details including sample forms, bookkeeping entries, and calculations, was presented before the 1942 A.F.S. Convention and has been published for the benefit of all foundrymen. Cost Committee Convention sessions each year offer refinements in foundry cost methods. And they constantly emphasize the importance and value of knowing costs accurately and of using the information wisely.

Sound cost methods have shown the foundryman the merits of "price per piece" and the demerits of "price per pound." Sound foundry casting tells the foundryman when he is using existing facilities to best advantage and gives him a basis for evaluating changes he may contemplate in men, materials, machines, and methods. Which foundry technique is most economical, which pieces of equipment are outmoded and need replacement can be determined with the help of a good cost system.

With the added incentive of CPR 60, foundries that need it should revamp their cost systems to take advantage of the information available on cost methods. This will enable them to comply more readily with regulations, to quote accurate prices, and to operate most efficiently.



RALPH L. LEE
Secretary-Treasurer
GREDE FOUNDRIES, INC.

Ralph L. Lee, secretary-treasurer, Grede Foundries, Inc., Milwaukee, has served continuously as chairman of the A.F.S. Foundry Cost Committee for over 11 years. In that capacity, and as a member of other groups interested in foundry costs, he has constantly promoted the use of modern and efficient cost methods in all types of foundries. A farm boy by birth, a lawyer by education, and a foundryman by experience, his service to the foundry industry was recognized at the 1949 A.F.S. Convention by the presentation of an Honorary Life Membership in the Society. In 1948 he prepared the A.F.S. exchange paper to the Institute of British Foundrymen—"Controlling Foundry Costs." *He has written a number of papers for presentation at A.F.S. Conventions, regional conferences, and chapter meetings, and for publication in* AMERICAN FOUNDRYMAN, *and is a regular participant in Convention cost sessions. Along with all his other out-of-the-plant activities, Mr. Lee has been a cost consultant to the Metals Branch of the Office of Price Stabilization.*

Duplex melting—wherein a cupola and air or electric furnace are operated in tandem—is particularly adaptable to many foundry mechanization programs because it provides a continuous supply of iron. Thus, simultaneous molding and pouring operations can be undertaken and developed to a remarkable degree of efficiency. In this article, presented at the 1951 Ohio Regional Foundry Conference, the author, then with Albion Malleable Iron Co., Albion, Mich., describes standards for materials, equipment, operational procedures, and personnel training practiced in connection with successful malleable duplex melting operations.

RIGID CONTROLS AND STANDARDS IMPROVE DUPLEXING OPERATIONS

F. Coghlin, Jr.
Manager

Dock Foundry Co.
Three Rivers, Mich.

FIVE CONSIDERATIONS are paramount in good duplex melting practice. First, cupola and auxiliary furnace must be properly arranged so as to provide sufficient iron of the desired quality. Second, the melting department must be supplied with controlled melting materials. Third, operating personnel must be thoroughly trained in the use of equipment to produce metal of good quality economically. Fourth, sound operating standards must be established and strictly adhered to. Last, good preventive maintenance practices are necessary to insure smooth operation.

Primary requirement in setting up a duplexing operation is selection of equipment. This problem is of course more complex when rebuilding an old foundry than with new construction, but the main points to be considered are the same.

Provide for Extra Cupola Diameter

Cupola size and number of cupolas is dependent upon estimated demand and possible plant expansion. It would be folly to install one or two 72-in. cupolas with 12 ton per hr capacities, and then have foundry demand increase to a point far in excess of the capacity of these units. It is far better to provide for a little extra diameter and line down the cupolas when production cuts are necessary than to overtax them severely when demand goes up.

Choice of charging arrangement is important. There are many good types of charging equipment on the market with bucket types that can be used in conjunction with monorails, bridge or gantry cranes, or skip hoists. Bucket types include drop leaf arrangements—single, double and four-sectioned—conical side discharge, conical, and dump-over.

Each has its own advantages for certain types of work. For instance, it has been pretty well established that the dump-over charger is impractical in a production system because of difficulty in controlling coke and metal distribution. Bottom drop leaf buckets work out fairly well in general applications, but again, this type of equipment may cause high-density or distribution trouble. Preferred charging equipment for duplexing operations is the conical bucket or the conical side discharge bucket. Both of these types permit close control of dispersion of charge material in the cupola.

Adequate Charging Equipment Pays Off

Cost consideration in choosing a charging system cannot be overlooked, but it should be remembered that oxidation losses, excessive refractory burnout or fuel consumption caused by faulty charging equipment can quickly offset savings effected by buying cheaper types of equipment.

An accurate means of measuring charge constituents is also necessary. Precision in this operation cannot be too greatly stressed. Inadequate equipment results in improper charge proportions and can pyramid costs through waste, scrap, consumer rejects, and rework. All too often troubles that at first seem to stem from other sources can be traced to a mistake in charge preparation. Basically, the operation is simple enough that errors should be non-existant.

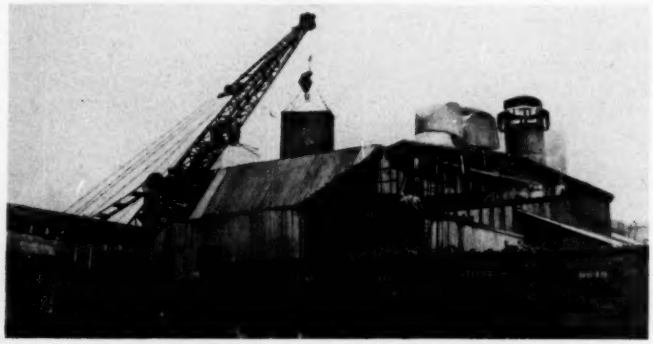


Fig. 1—Coke received in container cars at Albion Malleable is dumped by diesel crane into storage hopper, eliminating breakage caused by double handling and clamming. Discharge point of coke hopper is located directly over charge make-up weigh-hopper opening. Cupola charging dock (in background) consists of three revolving weigh-buckets fed by hoppers and electro magnets. Before unloading, sample is taken of each coke for checking with Albion Malleable's standards and with analysis from coking plant.

Fig. 2—Sprue and steel scrap are stored on turntables which rotate to keep constant metal supply under pick-up points of charging electromagnet. Sprue comes to turntable via conveyor belt, steel scrap by locomotive crane. Charging bucket turntable, located between sprue and steel turntables, has three weigh buckets for simultaneous loading of coke, steel, and sprue. Coke and limestone discharge into weigh bucket when it is indexed over four-sided, bottom-discharge bucket.

Complete elimination of errors will probably never come to pass but this state can be approached by use of simple, accurate and easily maintained weighing equipment.

Choice of a holding furnace is usually dictated by a foundry's geographical location, which affects fuel availability and costs. This does not hold true, however, in applications where production or quality demands influence furnace selection. The ordinary reverberatory, oil or pulverized coal furnace is widely used because it is acceptable both from cost and operational standpoints.

Electric Furnace Refining Speeds Process

Electric furnace refining is used successfully in some of the nation's largest and most progressive foundries. Set up in batteries of two to six electric furnaces, this method of white iron refining and superheating lends great versatility and speed to the process. Superheating can be done rapidly, analysis can be held closely, and alloy or other additions can be made simply and effectively.

Regulation of blast flow must be considered in buying equipment. For this purpose, it is necessary to have an instrument that controls within practical limits the blast volume or weight going into the cupola from the blower. An air-weight instrument automatically compensates for changes in atmospheric temperature and pressure, insuring a practically constant weight of oxygen. The volume type regulator requires a temperature and pressure adjustment.

Such auxiliary equipment as hot-blast dehumidifiers, water jackets, and dust collectors is gradually coming into more widespread use. Good hot-blast equipment is an asset to a production unit because it saves coke, reduces oxidation losses, produces hotter metal at the spout, reduces sulphur, improves metal uniformity, and keeps tuyeres cleaner by increasing slag fluidity.

From the cost standpoint the most desirable hot-blast unit is the type that gains its heat through an exchange from a waste heat source, or does so partially. The stack recuperator is a good example of this. Other hot-blast units include those that draw hot, discharged combustible gases from the cupola and burn them to heat air going into the cupola; and the wholly-externally fired air heater.

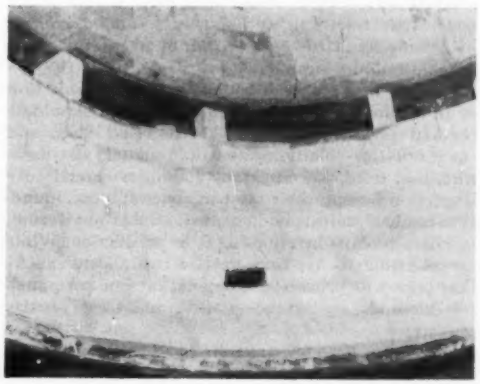
Moisture Control Advantages Vs. Costs

Reduction or control of moisture in the blast has several metallurgical advantages, but control and its effects must be weighed against cost of equipment and operation. Coke can be more closely controlled and possibly reduced through use of humidity control. Annealing of iron is usually improved and tendency of metal to set-up rapidly and cause shrinks is reduced, but here again advantages gained must be weighed against costs.

Water jackets are being used in many installations to provide longer cupola operating periods and to reduce burnout.

Smoke abatement and dust control is a major foundry problem. The time is coming when all but the most remote foundries will have to make an effort to control their dust emissions and ordinances have already gone into effect in some large cities. Equipment to do the work is generally costly, but it is expected that more efficient and economical equipment

Fig. 3—Cupola well details. Tuyeres are 24 in. from bottom plate and 16 in. from bottom of 2½ x 4 in. tap hole. Sand bottom is rammed straight across cupola from a point 10 in. below tuyeres to just above bottom of tap hole. Note tuyere overhang. Monolithic lining applied with a refractory gun is used in the melting area. Melting zone is 58-in. in diameter, with a 6-in. lining backed by a 96-in.-high water jacket.



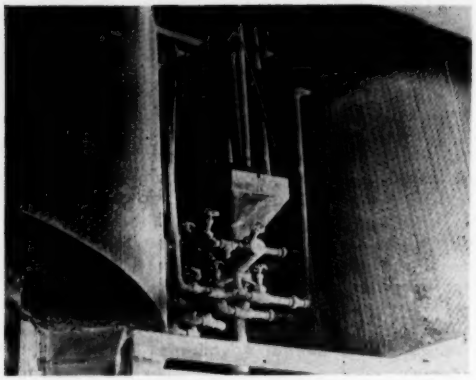


Fig. 4—Water flow control system for water jackets with individual temperature control adjustments. Hot discharge water quenches slag and carries it through a pipe located below and between the cupolas.

will be available to control emissions as smoke abatement rules gain general acceptance.

Tying the dust removal problem in with some means of recovering gases discharged from the cupola seems logical. The duplexing cost reduction evolving from heat recovery might then offset some of the cost of dust removal.

It is difficult to say which detail of duplexing deserves most attention. All are closely related and have equal influence on the over-all operation. Control of raw materials and fuel is highly important. True, corrections and partial compensations can be made for poor quality coke or bad steel, but this leads to lack of uniformity and high costs. There is no substitute for controlled materials and fuels.

Melting Stock Should Be Controlled

The same close laboratory control that is used in analysis of the iron should be used in connection with all melting stock. Standards should be set up to show the operational limits of all materials used in the foundry. These standards should be passed along to the supplier and a complete understanding should be reached with him to assure that these standards are met. Many rejections and shortages can be avoided by placing standards in the hands of an informed and reliable foundry supplier.

Next in importance is actual laboratory inspection of all incoming materials. For instance, coke should be checked physically for size, shatter, and fines, and chemically for volatile combustible matter, ash, moisture, and fixed carbon. Many foundries extend coke inspection beyond these basic analyses and one foundry actually tests its coke in a small cupola to ascertain its characteristics before using it in production. While no coke analysis has been devised to indicate exactly how coke will behave in a cupola, present coke analysis methods are an adequate guide to day-to-day operation.

Steel scrap must be controlled and avoidance of alloy steels, free-cutting steels, non-metallics, non-ferrous materials and rusty scrap should be of prime consideration on the inspector's list. Size is also of major importance and standards on length and thickness should be set and rigidly enforced. Light steel causes excessive oxidation losses, slow melting, excessive lining erosion and, at times, erratic analysis. On the other hand, steel too large for the cupola can cause hang-ups and bridging.

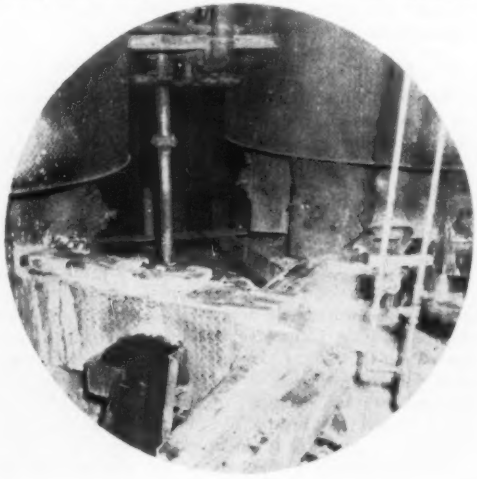
Outside malleable scrap or white cast iron should be purchased only from reliable sources. It is difficult to obtain a representative sample of any quantity of this material without running an exhaustive analysis. Knowing the foundry in which the material is produced is helpful, but this information is not always available. Average analysis of chromium, sulphur, phosphorus, silicon and manganese, as well as residuals should be determined before any foreign malleable or white scrap is used.

Control Of Duplexing Alloys

Alloys to be used in duplexing must be closely controlled. Ferrosilicon, ferromanganese or briquettes must be checked for percentage of contained alloy. This is necessary from both cost and operating standpoints. Excessive aluminum is at times encountered in ferrosilicon and can be extremely detrimental to some malleable operations. The carbon range of ferromanganese should be controlled so as to tie in with operational requirements. Limestone should be controlled for size, dirt, and acid matter.

Such refractories as furnace brick, cupola blocks, bonding clays, and monolithic lining material must be standardized and controlled to insure quality and low-cost operation. Furnace brick and cupola blocks must be held to close dimensional limits and should be of

Fig. 5—Refractory cross-over and spout slaggers for the two cupolas, which can be run simultaneously or singly into either of the air furnaces. The small trough at the side of the spout is used to drain the slagger and cupola well at end of the heat. Cupola metal temperatures run 2790-2830 F on an average.



proper heat duty, panel spalling, and porosity. Generally, in an air furnace a superduty brick with panel spalling under 3 and porosity under 18 will be satisfactory. Bonding clays should be at least equal in fusion point to the refractories being used. Monolithic cupola linings have probably reached a point of temporary standardization in some plants and it is the author's opinion that this worthwhile development will be further improved to become an even greater foundry money saver than it already is.

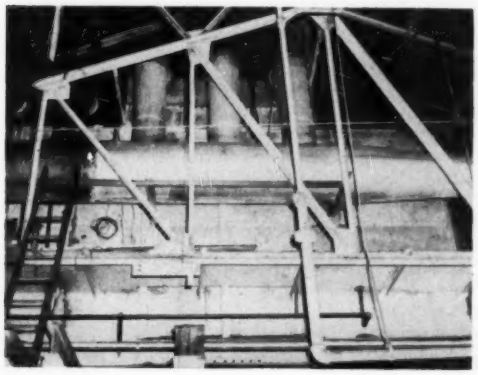
By creating standards for raw materials, fuel and manufacturing materials and setting up the necessary controls for these standards, melting personnel is given tools for doing a quality job.

Next step in establishing a good duplexing operation is thorough training of operating personnel. Each man must be taught the details of his job and the overall operation of the department. Teamwork in melting is probably more important than in any other foundry operation and workers should constantly be reminded of the need for cooperation, accuracy, attention to details and follow-up.

Melting department operating standards eliminate functional variables, promote product uniformity, and improve labor efficiency. These standards should comprise a complete working manual clearly outlining all departmental operating detail, furnace and cupola construction detail and drawings, care of equipment, action to be taken in emergencies, and housekeeping practices. These standards should also include job descriptions and a clarification of each employee's responsibility, both from inter-departmental and intra-departmental points of view.

It is well to have the metallurgical and operational departments work closely together in preparing these standards, with each point discussed jointly and agreed upon. In this way, both factions, having created the rules, are more likely to abide by them.

Fig. 6—Metallic stack recuperator. Hot discharge air furnace gases are deflected by an air-cooled damper up the stack and through the recuperator housing. Air from cupola blowers is forced through a system of alloy tubes and after absorbing heat from stack gases, passes into cupola. Heat recovery yields 400 F air at tuyeres, saving on coke. Ratio of metal to coke is 8.5 to 1 with hot blast, 7 to 1 with cold blast.



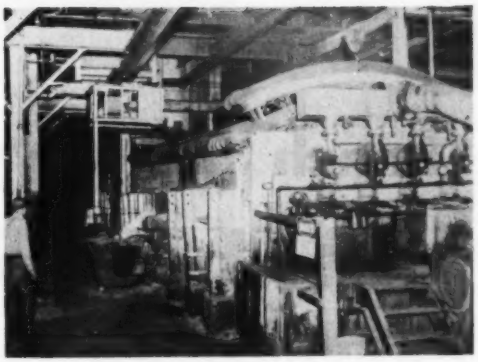


Fig. 7—View of oil-fired air furnace. Low-pressure, 4-8 in. luminous flame burners operate on No. 6 residual fuel oil at 60 psi and 200 F. Oil consumption per ton runs 11 to 15 gal. Furnace is 8½ ft wide and 32 ft long inside, has a 65-ton capacity, and effectively superheats and reduces carbon on a 40-ton-per-hr turnover. Super-duty firebrick lining averages about one-and-one-half 9 in. equivalents per ton. Tapping out is done from 1½-in. diameter blocks.

As an example, Albion Malleable Iron Co. until three years ago operated strictly from a daily log sheet which told the melter what the charge should be, how much coke and limestone to use, and what the bed height should be. From this point on, operations were based solely on the melter's experience and on word-of-mouth instructions from the metallurgist.

Loose as this system was, it worked out fairly well but problems kept cropping up that could be traced to some operational change made without sufficient forethought. A little too much coke in the bed, a small change in tuyere height, or an unintentional change in the furnace bung line were typical of these variations, which, small as they were, usually resulted in a chain reaction disrupting operations.

Recognizing the need to eliminate these variables, the foundry established a firm set of standards. Completion of the job took about nine months, but in the interim, standards were put in force as they were developed. In force today, these regulations are subject to constant revision. Adjustments are always made jointly and without delay by interested departments.

Enforcement of these standards led to many improvements in the department. Analysis control became more uniform and the number of adjustments dropped. Materials and labor costs were reduced and stabilized. Men took a greater interest in their jobs.

Maintenance of all melting equipment is of major importance. The maintenance crew should be well acquainted with all equipment in the department and have an established checking program.

Melting in a malleable foundry is the most important operation in the control of quality and cost of product. A mediocre foundry operation can live with a good melting operation but no foundry annealing or finishing operation, or customer relations department can survive poor melting operations.

Launch Industry-Sponsored SAFETY & HYGIENE &

A 10-YEAR ALL-INCLUSIVE TECHNICAL PROGRAM in safety and hygiene and air pollution is being initiated by the American Foundrymen's Society. Thus, the Society's former Safety & Hygiene Program, which developed the six widely used sets of recommended practices during the late 1930's, is now revived and broadened to include air pollution—of major interest to foundries and other industry today.

To be financed by voluntary subscriptions and conducted by and for the foundry industry, the program will be directed by Kenneth M. Morse, newest A.F.S. staff member, working with committees of specialists in the related fields of foundry safety, hygiene and air pollution.

No more opportune time could be found for the initiation of this program. Once again our nation is faced with the need for a defense program in which the foundry industry is called upon for tremendous casting tonnages. Increasing social awareness is bringing public pressure for safer and healthier working conditions, even though facts on the true relationship of foundry air pollution to chronic ill health are lacking.

Castings technology has advanced more in the last 50 years than in all the centuries since man first poured metal into molds. The foundry industry has achieved this by its own efforts. Now it has the opportunity to develop its own standards of working conditions in anticipation of demands that may be made upon it.

Why Such a Program?

Studies of foundry workers' health show that although working conditions have improved greatly in the last 20 years, dust still is considered a health hazard, partly because the effect of dust on lungs is not fully understood.

The changing technology of the metal castings industry and the use of new materials, equipment and processes, plus greater activity due to increased tonnage per square foot of foundry floor space, has created new interest on the part of foundrymen in safety, hygiene and air pollution.

Attention to air pollution control has been greatly increased during the last three years and many influential groups are participating in campaigns for cleaner air. The result has been a marked increase in air pollution ordinances and control agencies. The importance of this development to foundries is obvious.

Of equal significance is the increasing role of government in the conduct of industry. This requires that industry cooperate more fully with federal, state and city agencies to insure that impossible-to-comply-with regulations are not passed.

One of the principal advantages of a foundry Safety and Hygiene and Air Pollution Program is the attraction of high quality personnel to the foundry industry. This in itself should result in improved foundry production and product quality. Safety and hygiene programs have time and again proven profitable to industry in terms of lower insurance rates, less work stoppages and fewer machine damages. Today, with ever-increasing labor, equipment and material costs, profitable production can only be achieved by efficient use of machines.

State workmen's compensation laws are being liberalized both as to coverage and maximum awards. For example, some states do not limit benefits for incurring dust diseases. In some states, even aggravation of pre-existent diseases or injuries is being made compensable. The result is an increase in industry's insurance rates.

In some localities, foundries are automatically declared to be a major source of air pollution, and several claims for health and property damage have been filed against them. Regardless of the outcome of such actions, the industry must develop a realistic approach and program, if only to satisfy public demand.

Otherwise, such emotional public demand may develop that ill-advised and extremely costly regulations may be passed by local authorities. In addition, worker demands for improved conditions may prove unreasonable and involve unwarranted expense, unless technical data are available to disprove such allegations.

Today, 67 city county air pollution control agencies exist, 22 established since 1948. Their regulations may prove restrictive and costly if the foundry industry does not offer them technical assistance.

Safety, hygiene and air pollution thus becomes an

AIR POLLUTION
Program for Foundries

industry-wide problem and both large and small plants should support such a program both technically and financially. All industry benefits or suffers with the improvement or deterioration of working conditions. For example, regulations may be more extensive than necessary because of conditions found in a minority of plants.

In its own interest, the foundry industry must coordinate the experience and abilities of its best technicians and operating men in a collective effort to devise the most practical and economical method of overcoming its safety and hygiene problems.

Greater effort is needed to publicize industry's contributions to the public welfare. Few better opportunities exist for improving public attitude than in safety, hygiene and air pollution.

Why Should A.F.S. Carry Out the Program?

The metal castings industry should assume leadership in developing workable safety, hygiene and air pollution standards, as it has traditionally solved its other technical problems. When the Society first recognized the need for such a program it presented the idea to the National Castings Council, composed of all major foundry associations. That body, after full study, expressed the opinion that A.F.S. alone should carry out the program for the castings industry.

A.F.S. is a non-profit society for bettering the foundry industry, its methods, and its products. It has, in the 55 years of its existence, established an international reputation for professional integrity and scientific advancement. A.F.S. has not engaged in legislative or management-labor discussions or activities. Consequently any program of the American Foundrymen's Society is immediately recognized as unbiased, scientific and authoritative.

As early as 1937-39, A.F.S. had an Industrial Hygiene Committee, under the chairmanship of James R. Allan, International Harvester Co. Recommended practices developed by this committee have been of great value in indicating to legislative bodies the progressive spirit of the castings industry, and have served as a basis for state regulatory codes.

Both governmental and technical agencies have asked A.F.S. to cooperate in their work. The Society's former leadership in the development of good indus-

Before (left) and after (right) photographs shown below indicate how thick fumes from a 12 ton side charge furnace were eliminated in one foundry by installation of modern furnace ventilating equipment.

trial practices can be re-established and an even greater service performed by broadening the program to include cause-and-control technical aspects of industrial safety and hygiene. The much-needed expansion of the program to include air pollution will provide full coverage of the foundry industry's interests in these fields.

What Is the Program?

The new A.F.S. Safety & Hygiene & Air Pollution Program is to be broad in scope and long in range. The Society's Board of Directors has voted a program that will include all technical aspects of these fields. The final program will be determined by the Safety & Hygiene & Air Pollution Committee and approved by the A.F.S. Board. As tentatively planned, the program's four major features are:

Preparation of Good Practice Manuals. Present A.F.S. industrial hygiene codes will be reviewed for any desirable changes and manuals of rcommended practices prepared.

Research. A review of technical and medical literature on the subject will be made and research institutions visited. In this way, needs for additional research will be determined. Data will be gathered on existing industrial hygiene installations and on methods and procedures.

Education. An intensive program is planned in cooperation with A.F.S. chapters. Regional seminars will be held on methods of instilling good safety, hygiene and air pollution practices into foreman, apprentice and student training programs. Data from these seminars will be made available in printed form to the membership.

Relations with Professional and Regulatory Agencies. A.F.S. will cooperate closely with these bodies to further mutual understanding of industry and agency programs, views and policies. Constructive comments and suggestions will be made on proposed regulations and administrative policies.

Administration of the Program

The Safety & Hygiene & Air Pollution Program will be operated in the traditional A.F.S. manner—through recommendations of appropriate committees, subject to the approval of the Board of Directors.

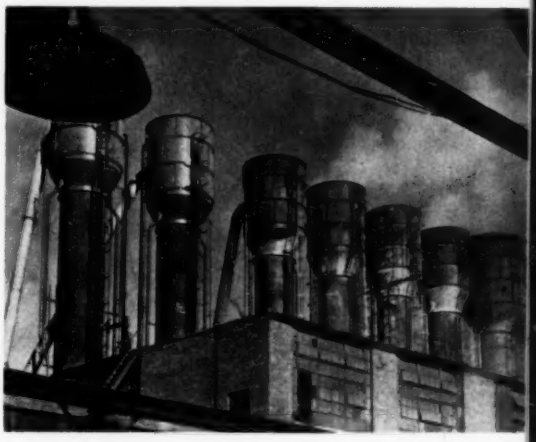
Initial step in the program was the appointment on August 1 of Kenneth M. Morse as program director. Mr. Morse was chief of the Illinois Department of Health's Bureau of Industrial Hygiene for eight years before coming to A.F.S., and is a consultant to the Argonne National Laboratory and a member of the faculty of the University of Illinois College of Medicine. He also belongs to the Chicago Cleaner Air Committee and is past chairman of the American Association of Industrial Hygienists' Air Pollution and Industrial Ventilation Committees.

During his 18 years' experience in both technical and administrative phases of industrial hygiene, Morse has worked closely with ferrous and non-ferrous foundries in the solution of safety, hygiene and air pollution problems.

To develop support required for this major project of the industry, the A.F.S. Board last year appointed a Safety & Hygiene & Air Pollution Committee of the Board to develop a fair and proper basis for solicitation of funds. Chairman of the committee is the present A.F.S. president—Walter L. Seelbach, Superior Foundry, Inc., Cleveland. Members are directors Frank W. Shipley, Caterpillar Tractor Co., Peoria, Ill., and James Thomson, Continental Foundry & Machine Co., East Chicago, Ind.

While all contributions will be voluntary, it has been recognized that size of working force and tonnage both affect management's interest in internal and external plant conditions. Contributions may be determined by individual foundry companies on the basis of casting tonnages. In the case of suppliers to the industry on the basis of dollar volume of sales to the industry.

The need for the program has been recognized by all branches of the casting industry. A.F.S. believes that the industry will actively and promptly support the new Safety & Hygiene & Air Pollution Program.



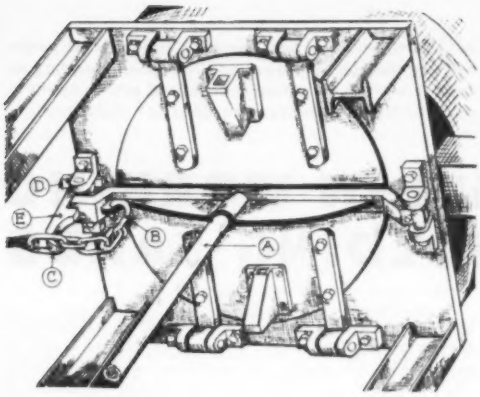
Cupolas in this large automotive foundry have been equipped with wet-type smoke and dust suppressors.

IBF, A.F.S. Exchange Congratulations

MUTUAL CONGRATULATORY MESSAGES between the Institute of British Foundrymen and the American Foundrymen's Society crossed the Atlantic on the occasion of IBF's Annual Meeting at Newcastle, June 13.

IBF to A.F.S.: "WE HAVE ALWAYS FELT THAT WE HAVE VERY CLOSE ASSOCIATION WITH OUR FRIENDS IN A.F.S. EVERY YEAR AT THE CONFERENCE WE REMEMBER THEM AND WITH VERY GREAT PLEASURE ASK THE AMERICAN FOUNDRYMEN'S SOCIETY TO ACCEPT THE FRATERNAL GREETINGS AND GOOD WISHES OF THE INSTITUTE OF BRITISH FOUNDRYMEN."

A.F.S. to IBF: "WE DEEPLY APPRECIATE THE EXPRESSION OF YOUR CONTINUED GOOD WILL AND IN OUR TURN WISH TO EXTEND TO IBF AND ITS MEMBERS OUR HEARTIEST CONGRATULATIONS ON ANOTHER SUCCESSFUL GENERAL MEETING AND HOPE THAT WE MAY MEET MANY OF YOUR MEMBERS AGAIN ON THE OCCASION OF THE 1952 INTERNATIONAL FOUNDRY CONGRESS IN THE UNITED STATES."



Dropping cupola bottom doors at the end of a heat may be a risky operation for the man who knocks out the supporting prop. This is especially true if the area below the drop bottom doors can become waterlogged and can cause explosive splattering when hot slag and coke are dropped onto it. In this article, reprinted from the May 10, issue of England's *Foundry Trade Journal*, James Timbrell recommends a cupola bottom arrangement that makes dropping the bottom of a cupola an easy, safe operation.

◀ *Fig. 1. Worm's-eye view of safe arrangement for dropping cupola bottom doors at end of a heat.*

DROPPING THE CUPOLA BOTTOM

A MORE RELIABLE and safer method of dropping cupola bottoms is needed in foundries where standard practice is to "knock the prop down and jump for cover." This is particularly true in instances where the cupola is located outside the main foundry building, with little cover below the platform.

An arrangement which is positive in action and permits the "dropper" to stand clear (Fig. 1) can easily be modified to suit most types of drop bottom cupolas. For small cupolas, the steel tube center prop *A* can be dispensed with, but for 30-in. diameter and over cupolas the prop insures rigidity and safety. The prop is knocked out at the end of a blow after attaching the hook *B* and chain *C*.

Safety wedge D, put in when drop doors are lifted as a precaution to prevent accidentally knocking the catch open, is also removed. Next, a pull on the rope

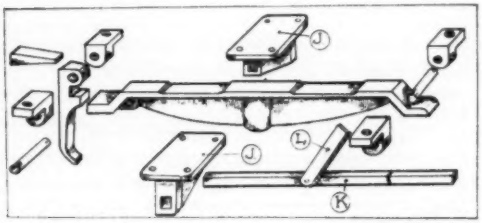


Fig. 2. Details of parts for arrangement in Fig. 1.

opens the catch *E*, permitting extra chain links and hook to be pulled free of debris. Figure 2 shows the arrangement in detail.

The ideal drop is that which consistently falls the minute the drop doors are released. An experienced cupola man can usually anticipate the fall to almost a second and is aware of what can happen. Speed of the drop is controlled by bond strength and dampness of bed sand, hardness of ramming, and length of heat. The longer the heat, the deeper and more vitrified the crust of bottom cake becomes, as shown at *F*. The bottom cake also becomes part of the cupola well

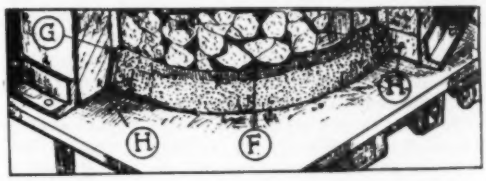


Fig. 3. Sectional view of cupola base showing formation of vitreous crust on bottom cake and course of brick bevelled to make bottom drop more readily.

lining *G* and has to break away when the bottom is dropped.

Too strong a bed sand rammed hard will delay the drop and may require use of a long chisel bar to release it, adding to the risk during the poking operation. Alternatively, a soft-rammed bottom, or hard-rammed "rotten sand" is liable to disintegrate during the heat with disastrous results. An instantaneous drop is almost certain if the cupola well lining is dressed to a taper *H* and the cake will usually fall in one piece. This taper also permits dripping wall slag to fall clear.

Mechanical help is needed to lift drop doors on cupolas of 30-in. or more diameter. As shown in Fig. 4, square lever bar *K* with movable catch-piece *L* inserted in socket *J* will make the lifting of cupola bottom doors a one-man job.

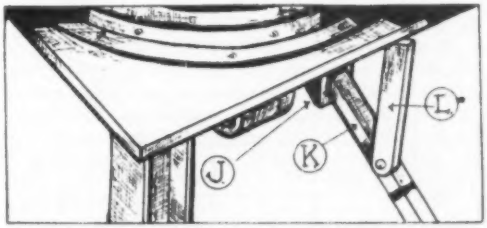


Fig. 4. Use of bracket-and-bar method makes closing of cupola drop bottom doors a one-man operation.

Methods for complete control of green strength and green deformation of molding sands, by which either may be increased or decreased and controlled independently at selected levels, employ an indicating type deformation tester. Safe working strengths of sands are maintained by proper additions and blending of bond materials to obtain the desired green strength, and control of moisture content for deformation.

CONTROLS FOR GREEN WORKING STRENGTHS OF MOLDING SANDS

H. W. Dietert
President
Harry W. Dietert Co.
Detroit

A SAND CONTROL PROGRAM should have a twofold objective: (1) providing a sand that is easy to work; and (2) the easy-to-work sand should produce high quality castings at a reasonable scrap loss.

Frequently, more money can be saved in the easy-to-work phase than in the casting quality phase. Present labor patterns now prescribe a sand that requires the minimum of thought and manual effort, whether it be from the supervisor or the actual manual workers.

In order to provide an easy-to-work sand, a sand is required that possesses a safe working strength so that the sand will take much abuse and the least amount of control. A safe working strength cannot be obtained by controlling only the green strength factor.

Working Strength: The green working strength of a molding sand consists of two distinct parts that require separate treatment and separate control. The part that determines the load-carrying ability is called green strength, and is measured either in tensile, shear or compression. The other part that determines the plasticity is called green deformation, and is measured by green deformation under load.

New Technique: Either the green strength or the green deformation may be increased or decreased at will, and either may be controlled independently at a selected level. For example, the green strength value may be either low or high, and green deformation value held at a constant selected value. In seven sands tested, the green compressive strength ranged from 5.4 to 11.0 psi, while the green deformation was maintained within 0.0145 to 0.0155. Or the green deformation value, that is, plasticity, may be raised or lowered and the strength value held at a selected value.

A new and valuable technique is available which is not receiving the attention it should. Green deformation or plasticity not only affects the green property of a sand, but its after-effects on air-set, dry and hot properties are important. Therefore, it should be controlled for two reasons: (1) its effect on ease of molding; and (2) effects on other properties of the sand.

Control Two Parts Separately: The product of green strength and green deformation values gives a sand toughness value which has received some application in the foundry. However, when such a single factor is used, detailed information necessary for complete control is lost. The sand requires a particular treatment for green strength control, and a separate particular treatment for green deformation or plasticity control. One numerical value such as sand toughness or impact test is not as desirable from a control standpoint as having two separate measurements—one to give information as to what to do about the bond strength, and the other about the plasticity.

Green Strength Control: The methods used for secur-

Fig. 1—Ready alteration of green deformation is afforded by changing the moisture contents of the sands.

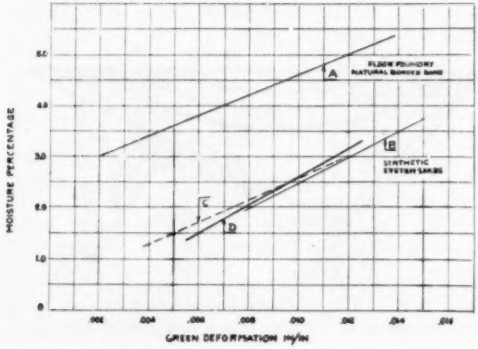
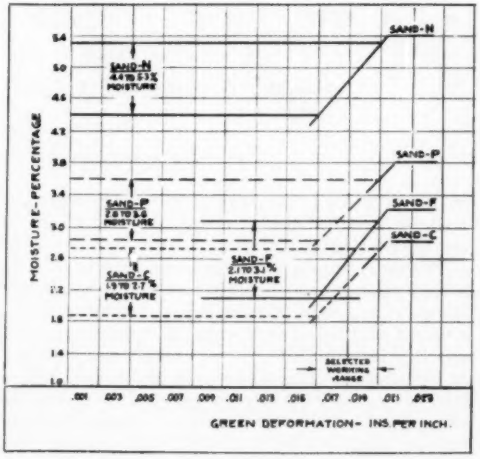


Fig. 2—Green deformation in the selected range is obtained by proper control of the moisture contents.



ing a selected green strength may be simply stated as the mixing or mulling of sand with contained or added clay, bentonite, cereal or other additives. A change in the mixing or mulling or a change in the type or quantity of clay or bentonite provides a control of the green strength part of the working strength of a sand.

Green Deformation Control: The green deformation of a sand may be most readily altered by a change in the moisture content of the sand of a given composition, as shown graphically in Fig. 1. Other means are by addition of cereal binders or addition of other plastic materials such as a very plastic clay. The blending of bonds also affords a control of green deformation.

The daily control of green deformation in a foundry is accomplished by addition of the proper amount of water to impart the desired plasticity and resulting in a green deformation within the selected range, for example, 0.016 to 0.020 for iron and non-ferrous molding sands. A good practice is to carry ample bond in the sand to produce the desired green strength, and then add sufficient moisture to obtain a green deformation reading within the selected range.

A graphic illustration of this practice is shown in Fig. 2. Here are four sands from four different gray iron foundries. Tempering each to yield between 0.016 to 0.020 green deformation will produce sands that are all at good working temper when sands are cool. Additional moisture must be added as sand becomes hot in the system. The water addition may thus be said to be for the purpose of imparting a given green deformation to the sand regardless of the percentage of moisture required.

For non-ferrous and iron sands without cereal, a good green deformation range for green sand molds lies within 0.016 to 0.020. This is a conservative range and is conducive to ease of molding and also to producing good after-effects on the air-set, dry, hot and retained sand properties.

How Much Moisture? One other point should be mentioned at this time, and that is the question of how much moisture a sand should have. This can now be answered definitely. Add sufficient moisture, or that percentage of moisture which will provide the desired selected green deformation. For example, for a normal gray iron foundry sand use the percentage of moisture that will give a green deformation range of 0.016-0.020.

Recording or Indicating Deformation Test: The question naturally arises as to whether an indicating or recording type of deformation tester should be used. Present day knowledge largely uses the ultimate deformation value so that an indicating type of deformation tester serves well for control testing. It is simpler to operate and faster than a recording deformation tester. However, both units measure the deformation simultaneously with green compressive strength.

A stress-strain diagram of a sand is shown in Fig. 3. Many sands deform at a rate proportional to the load applied up to a certain point. These sands have an apparent yield point allowing for determination of yield strength and yield deformation (Fig. 3). The ultimate deformation and ultimate strength is determined from maximum load point on the graph.

After-Effects of Green Deformation: The magnitude of green deformation value describes the degree of

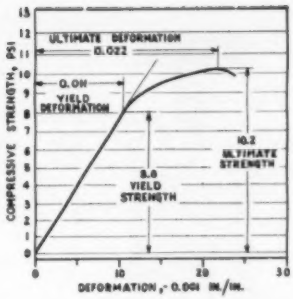


Fig. 3—Ultimate deformation and ultimate strength of a sand may be determined from the maximum load point on a stress-strain diagram.

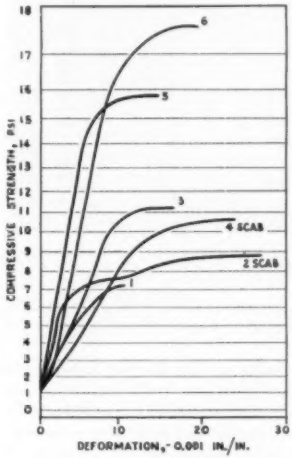
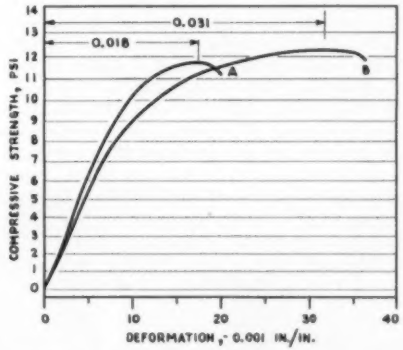


Fig. 4 (left)—Strength - deformation curves of six sands, two of which (above 0.025 green deformation) resulted in castings with scab defects.

Fig. 5 (below)—Strength - deformation curves of medium and high deformation sands show almost identical green compressive strengths. Yield strength of sand B is considerably less than that of sand A.



plasticity of the bond within the sand. The higher the deformation the higher the moisture percentage for a given mixture. The sand will also ram to a different hardness for a specific ramming. In addition, the air set, dry, hot and retained properties will change greatly. Thus, a variation in green deformation may cause a condition in one of the phases through which the sand passes in the casting process that will cause a casting defect.

An illustration of how a high green deformation above 0.025 may cause a condition which is conducive to scab defects is shown in Fig. 4 (sands Nos. 2 and 4).

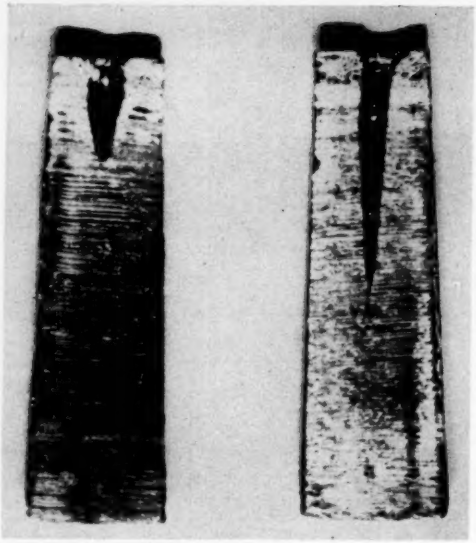


Fig. 6 – Lead test castings made in sands A and B (Fig. 5). Casting at right was made in high deformation sand B, and has greater piping and weight (1.53 lb) than casting (left) made in sand A, weight, 1.48 lb.

Green Deformation Influence on Casting Soundness: The soundness of a casting may be influenced by movement of the mold wall, thus increasing the volume of mold cavity after pouring is finished and after the ingate has set, but prior to complete solidification of the metal. This increase in mold volume may be timed by the nature of the sand so that insufficient metal is within the mold to fill the enlarged mold cavity. The mold wall must support the load of molten metal with very limited movement of the mold surface.

The green deformation test in the laboratory measures the movement of a rammed sand surface when a load is placed on the test specimen. Figure 5 shows the strength-deformation chart for two sands—A and B. The green compressive strength of these two sands is for all practical purposes identical. The yield strength of sand B is considerably less than that of sand A.

Castings made in these two sands are not of identical soundness. Typical lead test castings made in these sands are shown in Fig. 6. The casting made in sand B with 0.031 deformation shows much greater piping than that made in sand A. The casting made in the high deformation sand B weighs more than the casting made in the low deformation sand A. This substantiates the statement that the mold cavity increases more with a high green deformation sand.

The movement of these two sands under constant load is shown in Fig. 7. Here the sands were simultaneously subjected to a constant load below the ultimate strength. Deformation is plotted against time. These curves show that the high deformation sand B yields much faster under a constant load such as that imposed by molten metal. This causes the mold cavity to become unduly enlarged before the metal can solidify.

The test castings were made in metal flask equipment where all mating surfaces were machined. Both the drag and cope plates fitted on machined surfaces. The entire flask assembly was bolted solidly together so that the volume of the flask was identical for both test castings. The sand was rammed with a constant energy of a drop-weight rammer similar to the A.F.S. sand rammer. Thus, it becomes apparent that casting soundness may be affected by the sand green deformation.

Summary

The method of controlling green deformation may be briefly outlined as follows:

A. To decrease green deformation: (1) decrease moisture; (2) add cellulose materials: (a) wood flour; (b) treated wood flour products; (c) ground cereal hulls; (3) add sea coal; (4) add pitch; (5) use low plasticity clay bond.

B. To increase green deformation: (1) increase moisture; (2) add cereal binders; (3) add silica flour or fines; (4) use high plasticity clay or bentonitic bonds.

The real practical benefit of green deformation control exhibits itself in allowing safe working of a molding sand at relatively high green compressive strength, i.e., 15 psi, without entering into a sand condition that is too tough to mold or one that is conducive to casting defects.

When the green deformation of high strength sands for iron foundries is held at a conservative range, i.e., 0.016 to 0.020, a good moldable sand is obtained which can take much abuse in molding, core setting and pouring and be an easy sand to temper.

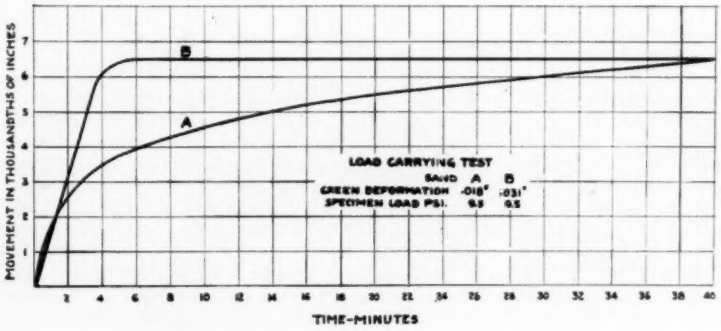


Fig. 7 – Movement curves of medium and high deformation sands A and B (Fig. 5) plotted from test data obtained when the sands were subjected simultaneously to a constant load below the ultimate strength.

A.F.S. International FOUNDRY CONGRESS & SHOW PLANS SHIFT TO HIGH GEAR

"Every Foundry in '52" is the slogan of the A.F.S. International Foundry Congress, to be held in Atlantic City, May 1 through 7, 1952, when top foundrymen from all over the world will meet to exchange technological information and to view exhibits of the world's outstanding foundry equipment, supply and service organizations.

Plans for the 1952 Show to be held in connection with the week-long Congress received added impetus recently when representatives of leading foundry equipment and supply firms, acting for the A.F.S. Exhibitors Committee, met with A.F.S. officials and representatives of the Atlantic City Convention Bureau to look over the world's largest convention hall and to finalize plans for the Show.

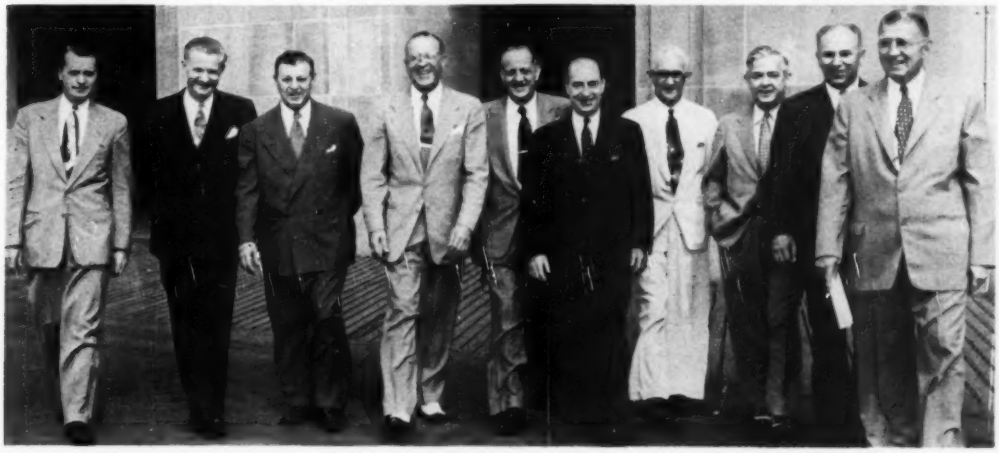
This year's International Foundry Congress will start on a Thursday and end on a Wednesday with the Annual Meeting of A.F.S., the Hoyt Annual Lecture, and the Annual Banquet in the middle of the period on Saturday. Sunday will be "International Day" with an International Reception for overseas guests and a United Kingdom Dinner. Sunday, May 4, will be devoted to committee meetings and exhibits. Foundrymen can register free of charge on this day.

Each day will have a special designation and theme—opening day, Thursday, May 1, is "Defense Day"—with activities geared to the theme.

Technical sessions will be held throughout the Congress, except Sunday. As is customary, light metals and brass and bronze meetings will be concentrated in the early days of the week-long meeting. Malleable iron, patternmaking, training and education, and general interest meetings will be held during the middle of the period. General interest meetings include papers and discussions on plant and plant equipment, safety & hygiene & air pollution, heat transfer, refractories, foundry costs, and time study and methods. The last half of the Convention will include the gray iron and steel sessions.

Arrangements are being made for a tour of United States foundries and other points of interest for international visitors.

Special events scheduled for the ladies, whose program runs simultaneously with the technical meetings and exhibits, include a tea, style show, and sightseeing tour of the Atlantic City area.



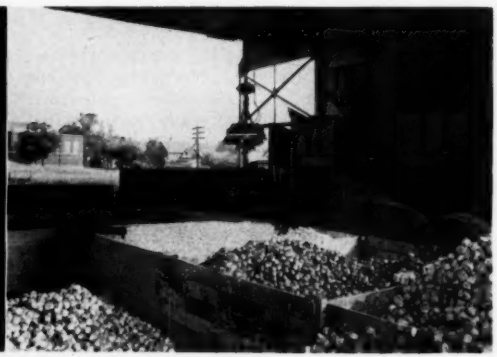
Pictured in front of Atlantic City Convention Hall, site of the 1952 A.F.S. International Foundry Congress & Show, as they met to discuss exhibits plans for the Congress August 14 were, left to right: Wayne Stetson, Atlantic City Convention Bureau; Russ Matthews, Bakelite Co., Division of Union Carbide & Carbon Corp.; A.F.S. Convention & Exhibits Manager A. A. Hilbron; W. L. Hartley, Link-Belt Co., Philadelphia; A.F.S. President Walter L. Seelbach; FEMA President C. V. Nass, Beardsley & Piper Co.; A. H. Boike, Link-Belt Co.; A.F.S. National Secretary-Treasurer Wm. W. Maloney; A.F.S. Technical Director S. C. Massari: and A. H. Skean, manager of the Atlantic City Convention and Tourist Bureau.

No molds are made in the Centrifugal Fusing Co. shop at Lansing, Mich., and the only sand used is for cupola bottoms. The molds are steel brake drums which come from a next-door fabricating plant to Centrifugal Fusing where the cast iron braking surface is centrifugally cast inside the drums. How this is accomplished, and the unusual equipment used to cast some 45,000 brake drums daily, has been described for AMERICAN FOUNDRYMAN by Frank A. Wagner, general manager, Albert Pierce, plant manager, and John Gedmin, production superintendent.

Heart of the operations are the four centrifugal casting machines. These consist of 22-ft turntables, each with 18 individually-powered, 8-jawed chucks for spinning the steel drums during casting. Each chuck, as it goes around on the 3-min cycle of the turntable, starts

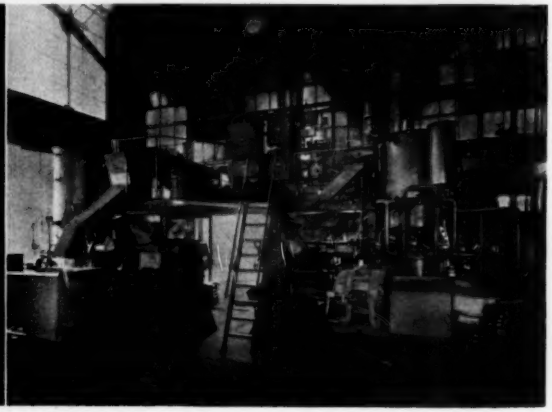
◀ *Extremes in sizes of brake drums cast by Centrifugal Fusing Co., Lansing, Mich., are illustrated by the small drum with a diameter less than the length of a cigarette and the large drum surrounding it—34 in. in diameter.*

UNUSUAL EQUIPMENT EMPLOYED TO MAKE CENTRIFUGALLY CAST BRAKE DRUMS



▲ *Charging bucket is filled from bins arranged in semicircle. At right is outside view of bins (coke hopper overhead) and storage areas for metal and limestone.*

▼ *Briquetting presses receive turnings from 50-ton hopper. Briquets discharge below grade into bucket conveyor (left) and empty automatically into charge makeup bin.*

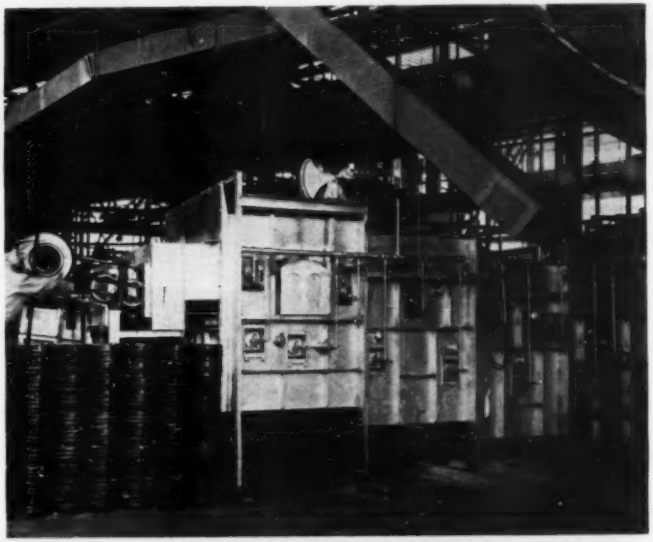


...MODERN FOUNDRY METHODS

Wishbone for holding charging bucket during discharge is water cooled. Novel spillage pan is occasionally lifted with crane hook to dump spillage back into the cupola.

spinning, coasts, and brakes to a stop automatically. Each pair of turntables receives molten cast iron at about 2900 F from a direct-arc electric furnace. A water-cooled frame for each electric furnace roof gives it a life about 10 times that of the conventional roof. The electric furnaces tilt around a center of rotation at the nose to maintain the same spout level. Each furnace discharges into a tilting, refractory-lined box which is controlled by the same man who tilts the furnace to supply iron to either turntable in the unit. Metal flows down covered troughs to the pouring stations.

Production demands which today tax present facilities producing some 150,000 lb of iron for 22,000 brake drums per 8-hr shift will soon be augmented



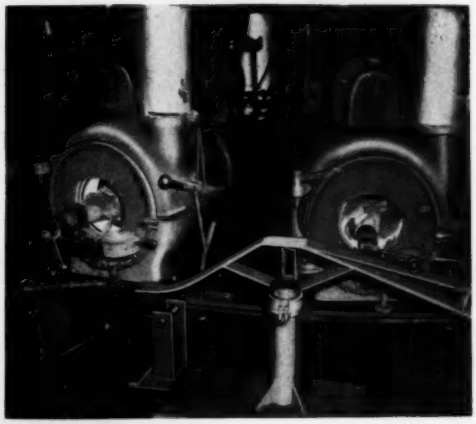
Steel shells in which the iron braking surface is cast are taken from storage pile in foreground and passed through preheating furnace to discharge at far end near casting machines. Operator puts small dipper of soda ash solution in shell as it starts rolling down water-cooled incline to flux interface between shell and molten iron during casting.

Discharged from the preheating furnace at about 1400 F, steel shell rolls down a chute to casting machine where it is inserted in 8-jawed chuck. Carried toward background, mold goes from a standstill to 900 rpm as operator at far left fills proportioning ladle which later pours the casting automatically. Ladle detail is shown in left foreground. Metal is poured into rectangular ladle with overflow going into hemispherical pig mold. Center man controls discharge from electric furnace, supplies pourers at right and left with metal.

MODERN FOUNDRY METHODS...

by a third electric furnace and a fifth turntable with space for a sixth. Iron for the furnaces is supplied by two 66-in. hot-blast cupolas installed July 1. They are operated on alternate days. Blast is heated externally by oil or gas. Cupolas are cooled with 41-in. high water jackets which start just above the tuyeres. Water jackets consist of eight separate sections, each separately supplied with water. Discharge from each segment is thermostatically controlled to approximately 120 F. Water which cools the cupola also cools the wishbone, provides a water curtain which stops sparks and cinders at the top of the cupola, and frits the slag. Slag and cinder collect in a sump; the water is recirculated. Brick lining in the water jacket area is only 1 in. thick. The cupolas are lined and patched with an air placement refractory gun constructed by Centrifugal Fusing Co.

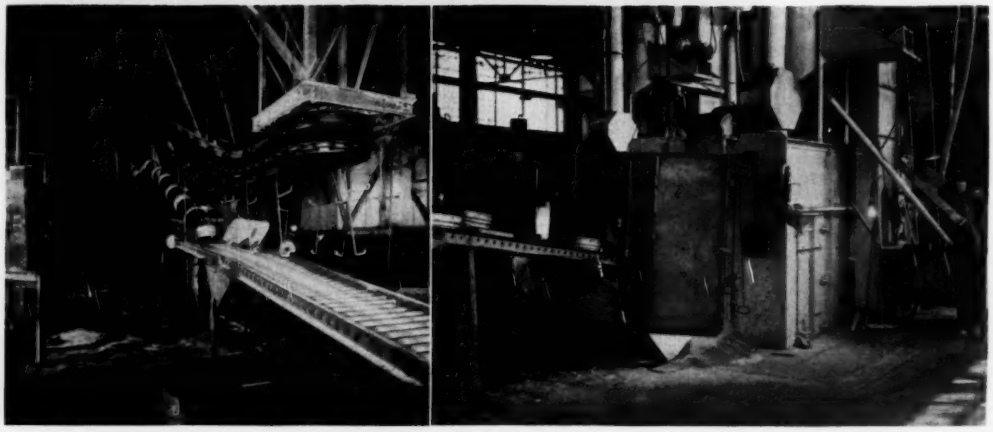
Cupola metal is intermittently tapped at about 2800 F into a 2500-lb transfer ladle and moved to electric furnaces via monorail. The cupola charge includes bri-



Casting is made as roller on ladle arm rises on inclined path shortly after passing pouring station.

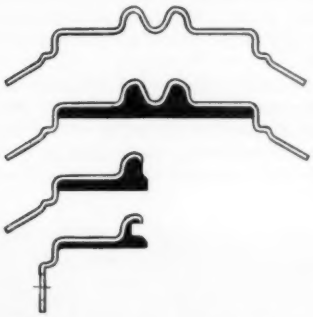
Spinning mold stops rotating, ladle and shield automatically swing out and yellow-hot drum falls onto roll conveyor ready for chain conveyor. Air current from grate at left keeps operator comfortable.

Drums cool on chain conveyor as they traverse 2000-ft back-and-forth course near roof, then come down to floor level where they automatically discharge into shot blast.



quetted cast iron borings, scrap iron, pig iron, limestone, and coke. Coke ratio is 6 to 1. Briquets are produced at the rate of 750 per hour by each of the machines. Short cylinders, 4 in. in diameter and weighing 9 lb, the briquets have a density approximately 85 per cent that of iron. They are pressed at 2000 psi; no binder is added.

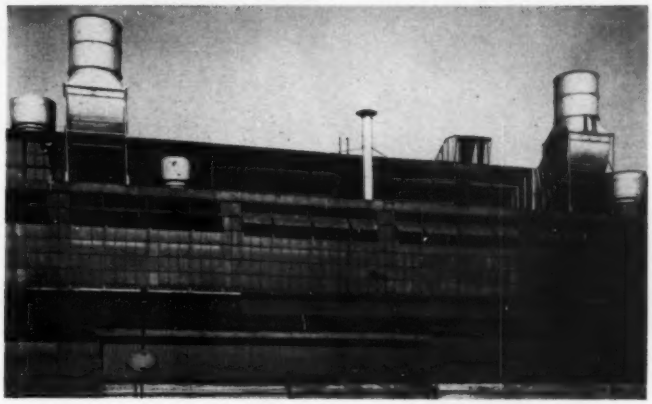
Control of metal weight in the drums is very important and the pouring system used keeps variations down to within 0.1 lb. Metal is metered by means of a small rectangular pouring ladle (complete sets have been made for each size of drum cast) with a pouring lip at one end, an overflow at the other end. Metal is run into the rectangular ladle until it overflows into a small hemispherical pig mold. The drums are automatically poured as illustrated on the facing page. Pig molds are emptied by hand shortly after the turntable passes pouring station.



Cross section of brake drum showing steel strip formed into double unit, cast iron fused in, separation into two drums, and final machining and drilling for installation on wheel.

Only treatment for the drums prior to machining is automatic shot-blasting. Drums pass through the blast unit on two parallel conveyor belts, one travelling slightly faster than the other, half of the drum on each belt. The speed differential causes the drum to rotate as it is blasted, cleaning it all around inside and outside.

Typical drum analysis is: TC, 3.70; Si, 1.90; Mn, 0.70; S, 0.05; Cr, 0.35; Mo, 0.35; Ni, 1.40.



The building has eight ventilating fans of 100,000 cfm capacity each which change air approximately every 60 seconds. Additional fans below floor level (right) bring air from outside through grates in floor wherever workers are subjected to heat.

Water-cooled cupolas are equipped with pneumatic door-closers. Piston forces roller down against lever on door to close it; door is locked in position during heat by means of steel pins. Cupola drop falls on steel pan, is carried away to dump on lift truck. Installed since this picture was made is a system for water disposal of slag.

Fig. 1—First, second, and third place winners (starting left) in the steel molding division. All three had sharp lines and clean surfaces. Risers all had proper necks, leaving clear lines for cut-off man to follow. High yield and soundness in first prize winner were achieved with high sprue, carbon rod in riser, and chills. Middle and right hand castings would have higher cleaning cost due to riser on flange. All used pressure risers.

1951 A.F.S. APPRENTICE CONTEST

Roy. W. Schroeder
Chairman
A.F.S. Apprentice Contest Committee

DESPITE THE WAR and the calling of young men into service, entries in the 1951 A.F.S. Apprentice Contest were only slightly fewer than in 1950. Following established custom, judges were selected from the Convention area and chosen for their wide experience. Sectional techniques were again apparent, raising the question: "Is there one best way to make a pattern or a casting?"

Lack of training in the fundamentals of the trades was apparent in some cases. For instance, in the wood patternmaking division time required to construct the entries ranged from 17 hours to 115½ hours. In judging, the entries requiring the longest time can lose six to eight points. The significance of this becomes more apparent when it is considered that the 115½-hr pattern (on the basis of the 50 castings assumed for purposes of the contest) would add a cost of over $4.50 to each casting.

Some of the patterns and coreboxes had a number of loose pieces. These always slow production, increase cleanout time, and increase the possibility of loss or breakage. Whether the core should be solid or pasted came in for considerable discussion by the judges and

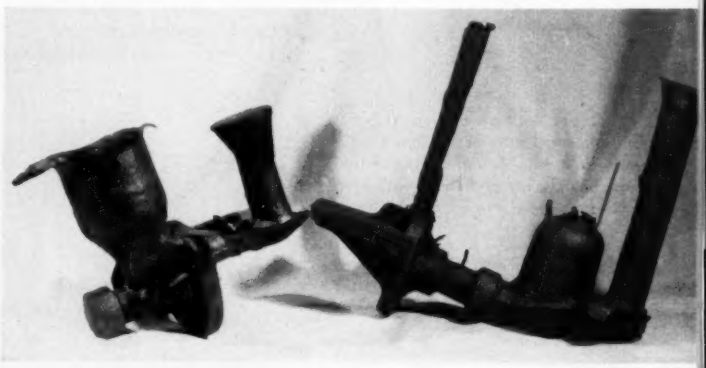


Fig. 2—An artist with a torch would be required to restore the original lines of the steel casting with the oversize riser. Value of the tall riser on the casting at the right is questionable; it is smaller in cross-section than the section it is to feed. If intended to be a flowoff it is unnecessarily large and reduces yield.

Fig. 3—Gating through a riser (below) was popular in the non-ferrous division as shown by the first (starting left), second, and third prize winners. Gate at right broke and is not shown in proper position.

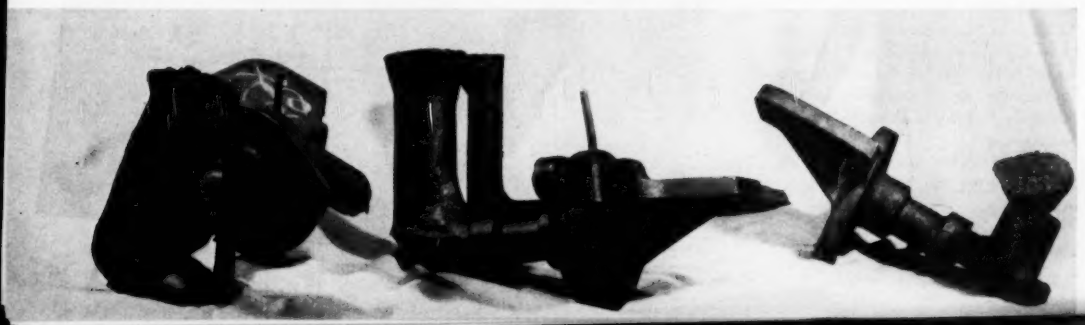


Fig. 4—Examining the first place steel casting are (left to right): E. J. McAfee, Puget Sound Naval Shipyard, Bremerton, Wash.; Apprentice John G. Polino, Dominion Engineering Works, Ltd., Lachine, Que., Canada; G. Ewing Tait Dominion Engineering; Roy W. Schroeder, University of Illinois, Chicago; Jos. E. Foster, A.F.S. Staff; and R. L. Selburg, Caterpillar Tractor Co., Peoria, Ill. Prof. Schroeder is chairman, and McAfee, Tait, and Selburg are members of the A.F.S. Apprentice Contest Committee.

by the foundrymen who examined the exhibit of castings and patterns during the Convention. On the contest pattern and box the production of a solid core calls for skilled work and doubt was expressed whether the type of box required would last through 50 cores without repairs.

Random remarks of foundrymen examining the entries at Convention indicate other criticisms of some of the patterns and coreboxes: We would not metal-face a box for 50 cores . . . No hand grips are provided for lifting the corebox . . . Too many loose pieces . . . Bedding-in frames not provided . . . Narrow sand strips between core prints or between core prints and patterns should be eliminated (example at right).

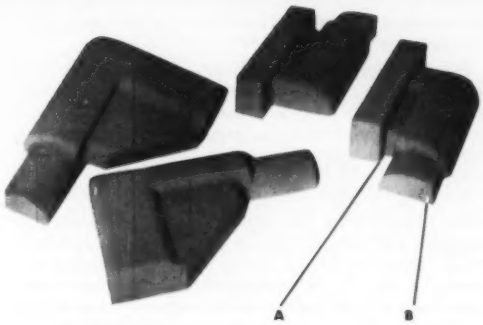


Fig. 5—Cores from first and third place wood pattern winners. Narrow pockets at A make third prize box difficult to draw, increase care necessary in setting core. Register at B is unnecessary, might shave mold.

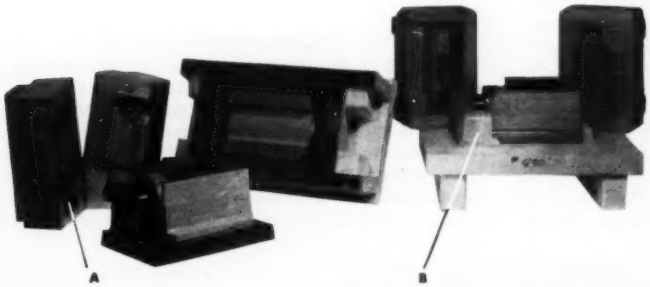


Fig. 6—Cover core simplifies molding (far left) but requires chaplets which might cause leakers. Stool at A would eliminate sagging. Soldiers might have to be used in cope at B.

Fig. 7—First, second, and third place winners (below left to right) in wood patternmaking. Close-over allowance at A prevents crushes. Second place winner had solid core but box had eight pieces with difficult-to-ram pocket at B. Core box at right has bottom extended at ends to facilitate drawing by coremaker.

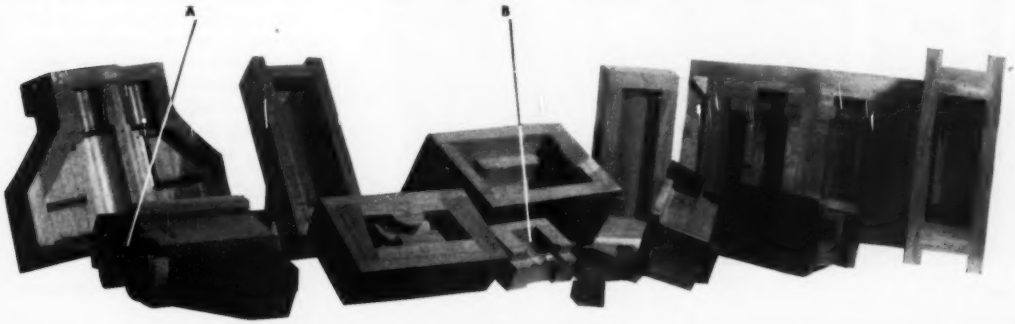


Fig. 8—Gray iron winners for 1951, first (starting left), second, and third. First place winner gated through riser with short neck creating condition similar to knock-off core. Result: smaller riser was adequate, yield was increased. Riser on third place winner is about twice the size. Buildup of riser and sprue on middle casting increase molding time, reduce yield.

In the metal patternmaking division, accuracy was given great weight by the judges and dimensions and tapers were carefully and laboriously measured. Some of the entries received too much work on the outside which required only removal of sharp corners and burrs.

All prize winning castings in the three molding divisions—gray iron, steel, and non-ferrous—were excellent, salable foundry products. Sharp parting lines, clean surfaces, and high yields characterized this year's best castings.

Best gray iron castings were free of fins, swells, and penetration in contrast to some of the poorer castings which showed soft ramming, poor or insufficient facing, or overly complicated gating. Several apprentices sacrificed yield by using excessively large pouring basins.

Versions of the atmospheric pressure riser were again popular this year among the steel molding apprentices as indicated by the prize winners. The first place winner used a carbon rod, the third place winner a core in his atmospheric riser. The second prize winner lost points on his square riser which sacrificed yield at a gain of very little feeding efficiency.

Gating through a riser was the most popular method employed in the non-ferrous entries. Risers on prize winners were constructed to leave well defined lines for removal, thus cutting down cleaning time. All non-ferrous entries had better surface finish and sharper parting lines than those submitted in 1950.

The thanks of the foundry industry and A.F.S. go to all who aided in conducting the 1951 Contest, especially: City Pattern Foundry & Machine Co., Detroit (metal castings for metal patternmaking division); City Pattern Foundry Co., Inc., South Bend, Ind. (aluminum patterns for molding divisions); Missouri Pattern Works, St. Louis (finishing of patterns for molding divisions); Caterpillar Tractor Co., Peoria, Ill. (shipping boxes for molding division patterns); New York State Institute of Applied Arts and Sciences, Buffalo (facilities for national judging); Pratt & Letchworth, Inc., Buffalo (x-ray facilities for inspection of contest castings); and Worthington Pump & Machinery Corp., Buffalo (templates for judging contest patterns).

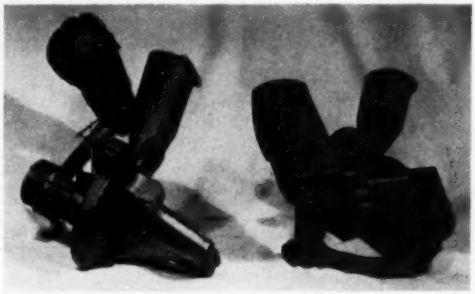


Fig. 9—Casting at left shows heavy fin and surface defect in drag near web. Mold was soft-rammed or lacked facing. Long in-gates on right hand casting were not made in facing sand, could have caused sand inclusions observed. Pouring basins are excessively large.

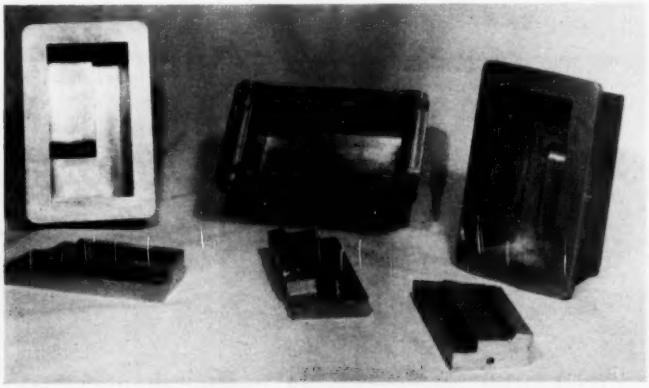


Fig. 10—Accuracy, the determining factor in the metal pattern division of the A.F.S. Apprentice Contest, makes judging of these entries rather lengthy. Ease of removal of the loose pieces, proper taper, finish of interior surfaces influences smoothness and accuracy of cores. Certain entries indicated that too much time was put on the exterior of the boxes. No work was required outside except breaking sharp corners or removing burrs. These prize winners are, left to right, first, second, and third. Metal patternmaking is the newest division of the 28-year old Apprentice Contest.

FOUR REGIONALS IN OCTOBER

REGIONAL FOUNDRY CONFERENCES scheduled for October will provide foundrymen in four widely separated areas with opportunities to exchange latest foundry ideas. The conferences are:

October 5-6: Northwest Regional Foundry Conference, Vancouver, British Columbia, Canada.

October 11-12: Michigan Regional Foundry Conference, East Lansing, Mich.

October 19-20: Texas Regional Foundry Conference, Houston, Tex.

October 19-20: New England Regional Foundry Conference, Cambridge, Mass.

Vancouver Is Host to Northwest Regional

The Northwest Regional is sponsored by the British Columbia, Washington, and Oregon Chapters, and the Oregon State College Student Chapter. General arrangements chairman is J. A. Dickson, Dickson Foundry Co., Vancouver, B.C. Others assisting with arrangements are: technical program, Lovick P. Young, A-1 Steel & Iron Foundry Ltd.; meeting facilities, housing and registration, Wm. R. Holeton, British Columbia Research Council; entertainment, Norman Shewring, Industrial Supplies Ltd.; finance, Herbert Heaton, Heap's Engineering (1946) Ltd.; and transportation, Alex Paterson, Terminal City Iron Works, Ltd.; all are from Vancouver.

Technical meetings will be held at the University of British Columbia. National Vice-President I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind., will speak at the Northwest Regional Foundry Conference banquet.

Regional Again at Michigan State

The 1951 Michigan Regional Foundry Conference will again be held at Michigan State College, East Lansing, Mich., under the sponsorship of the college and the following A.F.S chapters: Central Michigan, Detroit, Saginaw Valley, Western Michigan, and MSC Student Chapter. Heading arrangements are Professors Austen J. Smith and C. C. Sigerfoos of the Michigan State College faculty.

The Michigan Regional opens at 9:00 a.m., Thursday, October 11, in the MSC Union. Luncheons are scheduled for Thursday and Friday and the conference banquet—with A.F.S. President Walter L. Seelbach, Superior Foundry, Inc., Cleveland, as one of the speakers—will be held Thursday night.

The four technical sessions scheduled are entitled: Foundry Education in Secondary Schools, Dimensional Accuracy in Castings, Foundry Sands, and Quality Control. Discussion subjects include sand castings, shell molding, plaster molding, and prevention of gray iron casting defects due to sand.

New England Regional at MIT

The New England Regional Foundry Conference is under the chairmanship of Thomas I. Curtin, Waltham Foundry Co., Waltham, Mass. Sessions will be held October 19 and 20 at Massachusetts Institute of Technology, Cambridge, Mass.

Sponsors of the Texas Regional Foundry Conference are the Texas Chapter and the Texas A & M Student Chapter. To be held at the Shamrock Hotel in Houston, October 19 and 20, the Texas Regional is under the chairmanship of James R. Hewitt, Houston. A Texas barbecue, two luncheons, a banquet, three general meetings, and two sets of sectional meetings are on the program.

Friday, October 19

8:00-9:30 a.m.—REGISTRATION.

10:00-12:00 noon—GENERAL MEETING. John B. Caine, consultant, Wyoming, Ohio, *"Scabs, Buckles, and Spalls."*

12:30-1:45 p.m.—LUNCHEON. Speaker to be announced.

2:00-3:20 p.m.—GENERAL SESSION. R. L. McIlvaine, National Engineering Co., Chicago, *"Flow of Material in Foundry Bins and Hoppers."*

3:40-5:00 p.m.—SECTIONAL MEETINGS.

Gray Iron. H. H. Wilder, Vanadium Corp of America, Detroit, *"Cupola Practice for Gray Iron Foundries."*

Steel. To be announced.

Non-Ferrous. George P. Halliwell, H. Kramer & Co., Chicago, *"The Application of Some Fundamental Principles to the Melting, Pouring, and Casting of Copper-Base Alloys."*

6:30 p.m.—TEXAS BARBECUE.

Saturday, October 20

9:00-12:00 noon—E. B. Henby, National Engineering Co., Chicago, and J. A. Wickett, Monsanto Chemical Co., St. Louis, *"Shell Mold Casting Process."*

12:30-3:15 p.m.—LUNCHEON MEETING. Films: *"Mechanization in Molding,"* and *"The ADM of Cores."*

3:30-5:00 p.m.—SECTIONAL MEETINGS.

Gray Iron. Jack Holt, Basic Refractories, Inc., *"Basic Cupola Operation."*

Steel. To be announced.

Non-Ferrous. Michael Bock II, Exomet, Inc., Conneaut, Ohio, *"Insulating Sleeves."*

7:00 p.m.—BANQUET. Speaker to be announced.

Future Meetings and Exhibits

GERMAN FOUNDRYMEN'S SOCIETY, 42nd general meeting, Dusseldorf, Germany, Sept. 28-29.

MICHIGAN REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Detroit, Central Michigan, Saginaw Valley, Western Michigan Chapters, and Michigan State College Student Chapter, at Michigan State College, East Lansing, Mich., Oct. 11-12.

NATIONAL METAL CONGRESS & Exhibit, Detroit, Oct. 15-19.

TEXAS REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Texas Chapter, and Texas A. & M. Student Chapter, Shamrock Hotel, Houston, Texas, Oct. 19-20.

METALS CASTING CONFERENCE, sponsored by A.F.S. Central Indiana and Michiana Chapters, and Purdue University, at Purdue, West Lafayette, Ind., Nov. 1-2.

QUAD CITY REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Quad City Chapter, Blackhawk Hotel, Davenport, Iowa, Nov. 8-9.

SPANISH IRON & STEEL INSTITUTE, 2nd general assembly, Madrid, Spain, Dec. 10-15.

SOUTHERN REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Birmingham District and Tennessee Chapters, and University of Alabama Student Chapter, Tutwiler Hotel, Birmingham, Feb. 21-23, 1952.

1952 A.F.S. International Foundry Congress & Exhibit, American Foundrymen's Society, Atlantic City, N. J., May 1-7, 1952.

Sand and gravity die castings of magnesium-zirconium alloys have found many applications in airplane parts and turbo-jet engines. Extensive research developed a satisfactory method of introducing zirconium into magnesium, and the alloy has high strength-weight ratios and excellent mechanical properties. Melting, casting, and heat-treating practices are discussed, and alloy properties are tabulated.

Mg-Zr CASTING ALLOYS ATTAIN HIGH STRENGTH-WEIGHT RATIOS

H. J. Millward
Chief Metallurgist
Sterling Metals Ltd.
Coventry, England

MAGNESIUM BASE ALLOYS containing zinc and/or rare earth metals and grain refined with zirconium undoubtedly represent the greatest step forward that the ultralight alloys have attained. The high performance of modern aircraft could not have been obtained without them as they fulfill two essential features demanded, namely, ultralight weight combined with high strength-weight ratio, and excellent creep resistance at elevated temperatures of 200-250 C.

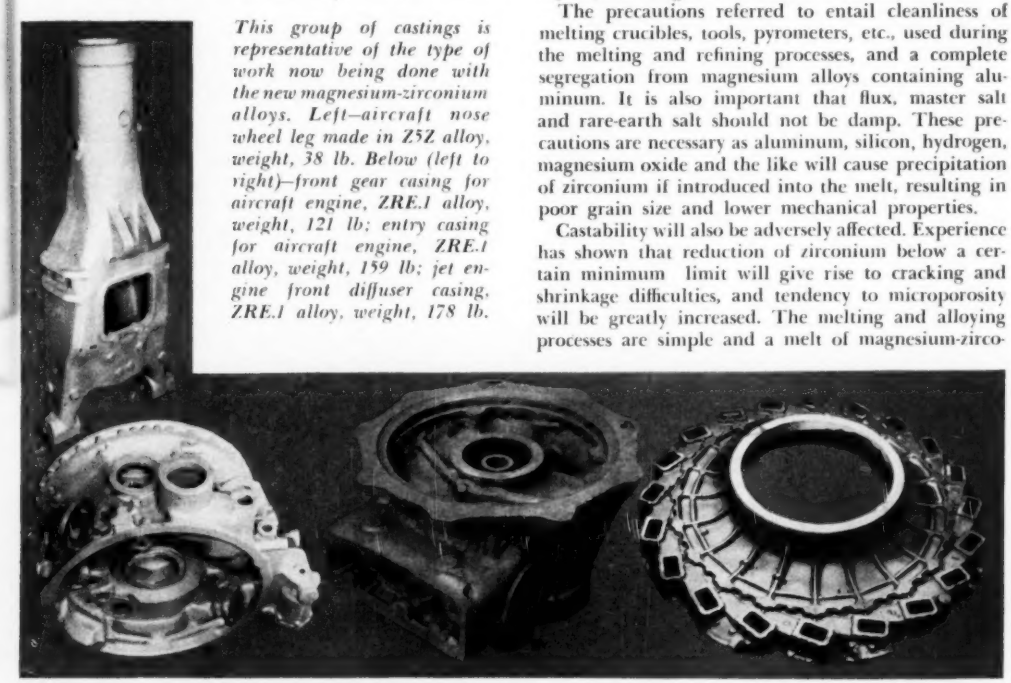
In Great Britain they have been used for sand and gravity die castings on a production scale for some 3 to 4 years, but only after extensive research work had solved the difficulty of introducing zirconium into magnesium and magnesium alloys by the master-salt method described by Ball.[1] The master salt referred to is a complex salt of zirconium which provides a very reliable way of adding zirconium to magnesium or magnesium alloys without introducing other undesirable non-metallics such as chloride particles.

Removal of these particles proved extremely troublesome in the early work of British technicians when other processes were being investigated. Master salt as known today is easy to use and storage presents no problem whatever.

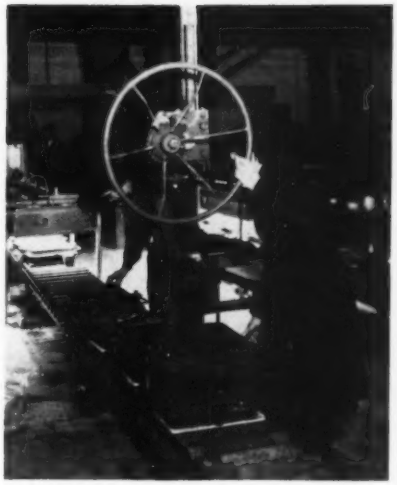
A "hardener" or master-alloy method similar to that mentioned by Nelson & Strieter[2] proved to be too expensive and unreliable and was consequently discarded. A suitable flux was also devised, this resembling the well-known melrasel "E" flux, but incorporating barium chloride to make it heavy and effect a quick and easy separation from the molten metal. The melting and casting of the magnesium-zirconium alloys is now firmly established in Great Britain and, provided a few simple precautions are taken, they are handled as easily, if not more easily, than the widely used magnesium-aluminum-zinc alloys, conforming to DTD.59B and DTD.136A, etc.

The precautions referred to entail cleanliness of melting crucibles, tools, pyrometers, etc., used during the melting and refining processes, and a complete segregation from magnesium alloys containing aluminum. It is also important that flux, master salt and rare-earth salt should not be damp. These precautions are necessary as aluminum, silicon, hydrogen, magnesium oxide and the like will cause precipitation of zirconium if introduced into the melt, resulting in poor grain size and lower mechanical properties.

Castability will also be adversely affected. Experience has shown that reduction of zirconium below a certain minimum limit will give rise to cracking and shrinkage difficulties, and tendency to microporosity will be greatly increased. The melting and alloying processes are simple and a melt of magnesium-zirco-



This group of castings is representative of the type of work now being done with the new magnesium-zirconium alloys. Left—aircraft nose wheel leg made in Z5Z alloy, weight, 38 lb. Below (left to right)—front gear casing for aircraft engine, ZRE.1 alloy, weight, 121 lb; entry casing for aircraft engine, ZRE.1 alloy, weight, 159 lb; jet engine front diffuser casing, ZRE.1 alloy, weight, 178 lb.



Views of the molding processes in the mechanized section of the magnesium foundry in which the smaller castings are produced. Cores are set and the molds closed on the roller conveyor system.

nium alloy requires only the same time as a similar sized melt of magnesium-aluminum alloy.

Pouring presents no problems different from those associated with the older alloys, and experience has shown that no alterations need be made to the molding and core sands. Similarly, die wash, when gravity die castings are being produced, needs no modification. Running, gating and feeding methods are somewhat different and these vary with the alloy used.

At present two main types of alloy are in regular production: magnesium-zinc-zirconium (Z5Z); and magnesium-rare earth-zirconium with an optional zinc addition (MCZ or ZRE.1). These alloys will be considered and discussed separately.

Magnesium-Zinc-Zirconium (Z5Z) Alloy: Nominal composition: zinc, 4.5 to 4.75 per cent; zirconium, 0.7 per cent; remainder magnesium.

This composition was decided on after much experiment and is considered to give the best combination of properties in the whole series, especially when heat treated at 170-200 C for 12-24 hr. Actually the alloy is amenable to many types of heat treatment which develop certain specific properties, but experience has shown that the one quoted above gives the best combination of proof stress, ultimate strength, elongation and fatigue properties. The alloy in this condition also has very low notch sensitivity in fatigue. In Table 1 alloy Z5Z is compared with DTD.289, the latter being the magnesium alloy that would be used for parts now made in Z5Z if that new alloy were not available.

An alloy of the American ZK.61 type (6 per cent zinc and 0.8 per cent zirconium) described by Meier and Martinson[3] and solution heat-treated at 500 C has not found favor in Great Britain for several reasons:

(1) The higher zinc content alloy is more prone to microporosity.

(2) Greater tendency to crack on solidification.

(3) Heat treatment at 500 C leads to distortion troubles in many castings.

(4) Alloy Z5Z with the simpler and cheaper single-stage low-temperature heat treatment has mechanical properties which compare very favorably with ZK.61 alloy in the solution treated and aged condition.

(5) An alloy containing 6 per cent of zinc becomes very sensitive to the effective zirconium content, and poor results will be obtained if this falls slightly for any reason. In this case the mechanical properties will fall below those of Z5Z even when the loss of effective zirconium content is only slight.

The alloy Z5Z is suitable for sand and gravity die castings required to function at temperatures up to 150 C and where high proof stress combined with good ultimate, elongation and fatigue resistance is essential. Applications falling into this class are mainly for aircraft and include nose and main landing wheel hubs, undercarriage parts, airframe structural parts, control gear, auxiliary electrical equipment, air-conditioning equipment and, to a small extent, engine components such as gas turbine air intakes, reduction gear casings, oil sumps, etc.

It is significant that the great majority of aircraft which were on view or flew at the Society of British Aircraft Constructors display held at Farnborough, England in 1950 incorporated Z5Z alloy castings in airframes or engines, or both.

Melting Practice: Ingots are supplied to the foundry in the already alloyed condition, i.e., all the zinc and some of the zirconium are incorporated. The remainder of the zirconium up to the optimum figure of approx. 0.7 per cent is added by means of the master salt referred to previously. Deep-drawn mild steel crucibles are used for melting and the metal charge of ingot or scrap is chargd with the necessary amount of master salt on top. The whole is allowed to melt under flux

TABLE 1-MAGNESIUM ALLOY PROPERTY COMPARISON
(all tests at room temperature)

Alloy	0.1% Proof Stress, tons/sq. in.	Ult. Tensile Strength, tons/sq. in.	Elongation, %	Fatigue Strength, tons/sq. in. Unnotched	Notched
Z5Z as cast	7-8	13-15	7-12	4 3/4-5 1/4	3 3/4-4 1/4
Z5Z heat treated	8.5-10	15-18	5-12	5-5 1/2	4 3/4-5 1/2
DTD. 289	4-5	13-16	6-12	5-5 3/4	4-4 1/2

and the master salt, being the heavier, sinks to the bottom of the melt.

At approximately 800 C a spade-shaped stirrer is used to puddle the melt for approximately 4 min. At this stage a chill-cast test piece is made, cooled and fractured for grain-size evaluation. This can be done by polishing and inspection and measurement by microscope, but an experienced operator can decide by visual examination of the fresh fracture if the melt is satisfactory for use.

If the grain size is satisfactory the melt is allowed to stand for at least 10 min to allow flux, etc., to settle and the temperature is adjusted for pouring. If grain size is not satisfactory, a further 2 to 4 min puddling is given, and a second chill test piece made, fractured and examined.

This is generally sufficient to put right the occasional doubtful melt, unless the material has become contaminated with aluminum or some zirconium precipitant, when a special procedure must be adopted to render the alloy usable as Z5Z. The average effective zirconium content of a satisfactory Z5Z melt is of the order of 0.7 per cent. Contents lower than 0.6 per cent almost inevitably lead to casting troubles such as microporosity and cracking.

On remelting, Z5Z loses some zirconium and it is essential to add master salt to each melt to replace it. The same proportion of master salt is added whether the charge is all scrap, all ingot, or a mixture.

Foundry Technique: In the case of airplane landing wheels, flanges, etc., Z5Z alloy produces a sounder casting in less development time than DTD.289, and many castings of this type have been produced satisfactorily in both alloys by the same running, feeding and chilling method. On a more intricate type of large casting, development time in Z5Z may be slightly longer than in DTD.289, and in some cases extra feed and less chill is necessary when Z5Z is used.

Ingates may also have to be made a little larger

Part of the pouring line in the mechanized section of the magnesium foundry handling smaller castings.

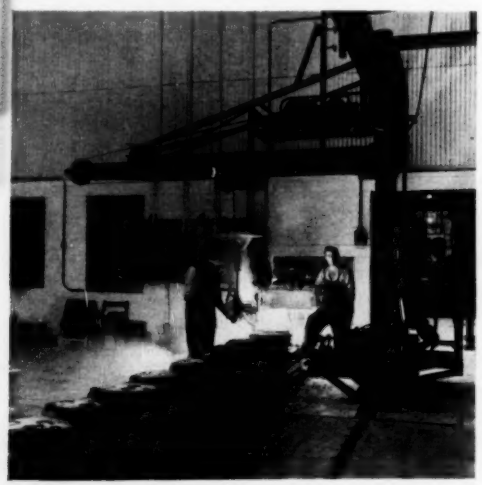


TABLE 2-MECHANICAL PROPERTIES OF MAGNESIUM ALLOYS

Alloy	Temperature, 20C 0.1% Proof Stress, tons/sq. in.	Ult. Tensile Strength, tons/sq. in.	Elongation, %	Temperature, 200C 0.1% Proof Stress, tons/sq. in.	Ult. Tensile Strength, tons/sq. in.	Elongation, %
136B	5-5.5	8-10	0-2	3.5-4.5	8-9	8-20
ZRE.1	5.5-6	9-11	3-6	4.5-5	8.5-10	20-25
MCZ	5.5-6	9-11	4-6	4.5-5	9-11	20-25

Creep Data at 200C Temperature

Alloy	Condition	Stress, tons/sq. in.	Approx. Creep Rate (Strain/hr) at 50-150 hr	Creep Strain at 120 hr, approx.
ZRE1.	Heat Treated 24hr at 180C	2.0	1×10^{-7}	0.00003
		3.0	11×10^{-7}	0.00015
		4.0	46×10^{-7}	0.0008
		4.5	80×10^{-7}	0.00146
AZ. 91 (DTD. 136B)	Heat Treated 4hr at 250C	1.0	180×10^{-7}	0.0039

and slightly higher pouring temperatures used for this alloy. Generally speaking, Z5Z is an excellent alloy for most types of castings, only certain types of large and complicated parts may show tendency to crack and this point should be carefully watched.

Magnesium-Rare Earth-Zirconium Alloy ZRE.1 or MCZ: Nominal composition MCZ alloy—rare earths, 2.5-3 per cent; zirconium, 0.6 per cent; remainder magnesium. ZRE.1 alloy has the same components plus 2.5 per cent zinc.

The alloys MCZ and ZRE.1 are widely used in Great Britain today as both compositions have good founding properties. ZRE.1 has a slight advantage in this direction being less prone to "sinks" and having slightly better fluidity. It is not quite so corrosion resistant. Although both alloys were developed primarily for high temperature applications by reason of their excellent creep resistant qualities, neither shows the slightest tendency to microporosity and both are excellent for castings which must withstand pressure.

Heat treatment of this class of material in Great Britain is done at temperatures no higher than 250 C, experience having shown that aging temperatures above this figure lead to a considerable drop in creep properties. The two-stage heat treatment recommended by Nelson & Strieter[2] (16 hr at 1050 F followed by 16 hr at 400 F) does not impair creep properties of the material, but solution heat treatment at 1050 F (570 C) entails grave risk of distortion of castings. There is also great tendency for the alloy to burn at 1050 F.

The alloy largely replaced by ZRE.1 and MCZ is the one conforming to DTD.136B, and a comparison of mechanical properties is given in Table 2.

The alloy ZRE.1/MCZ is suitable for sand and gravity die castings for use at elevated temperatures and has proved to be the solution of that problem on many turbo-jet units. ZRE.1 is now specified as the standard material for major castings on a number of prominent British jet engines because of its high creep resistant qualities at the temperature which these engines attain in service, and it is also used for many castings which must withstand high internal pressures.

High Temperature Applications: Engine components such as front and rear diffusers; supercharger casings; compressor casings; intermediate casings; entry casings; reduction gear casings; combustion chambers.

Pressure Tight Castings: Fuel junction galleries; filter casings of many varying types. In the latter case pressures up to 5,000 psi with kerosene have been held

Cages loaded with magnesium alloy castings for charging to heat-treating furnaces are shown in foreground. Heat-treating furnace line appears in background.

satisfactorily by sand castings made in this material.

Melting Practice: This is to all intents and purposes identical with the procedure already outlined for alloy Z5Z except that it is also necessary to revivify each melt with rare-earth metals to make up for the loss of these metals on melting.

This is also done by means of a complex salt mixture which is placed in the crucible with the master salt. It should be noted that a rare-earth addition must be made to each melt whether the melt comprises all virgin ingot, all scrap, or any mixture of both. There are no other significant variations between the procedure for ZRE.1 and that already mentioned for Z5Z.

Foundry Technique: Experience has shown that the alloy ZRE.1 is by far the easiest to handle of all the magnesium alloys. With this composition and the full amount of effective zirconium present (approx. 0.6 per cent), microporosity and hot cracking do not occur, and the most difficult and complicated castings can be produced to withstand high pressure with comparative ease. It has been found in practice that the development time taken to produce a satisfactory casting is much less than with any other magnesium alloy, including DTD.136B (AZ.91).

This is not the case with low zirconium contents of the order of 0.2 per cent as employed in the American alloy EK.30. Also many complicated and difficult sand castings have been produced in ZRE.1 without the slightest tendency to cracking on solidification. Oxide skins sometimes prove troublesome, but "bottom running" and other means of avoiding turbulence reduce these to a minimum or may remove them entirely. There need be no great modification to feeding and chilling when ZRE.1 is used in place of AZ.91.

References

1. Major O.J.P. Ball, *Metal Industry*, vol. 75. p. 152 (1949).
2. K.E. Nelson and P.F. Strieter, "Casting of Magnesium-Rare Earth-Zirconium Alloys in Sand Molds," A.F.S. TRANSACTIONS, vol. 58, pp. 400-410 (1950).
3. J. W. Meier and M. W. Martinson, "Development of High-Strength Magnesium Casting Alloy ZK61," A.F.S. TRANSACTIONS, vol. 58, pp. 742-751 (1950).

A.F.S. Home Donations Still Coming In

CONTRIBUTIONS to the A.F.S. Building Fund for a permanent home for the Society continue to arrive at the National Office. In addition to new contributors, several A.F.S. members, chapters and foundries, foundry equipment and supply firms have increased their original contributions in recent months. Plans are still going forward for selection of a site in the Chicago vicinity, and for choosing an architect and appropriate plans for the Society's permanent headquarters.

CHARTER SUBSCRIBERS

(July 20 - August 20)

CHAPTER CONTRIBUTORS

Tri-State Chapter*
Eastern New York Chapter*

INDIVIDUAL CONTRIBUTORS

R. H. Olmsted, Whitehead Bros., Inc., Conneaut, Ohio.

COMPANY CONTRIBUTORS

Chicago Hardware Foundry Co., North Chicago, Ill.

*Original contribution increased

Appoint Committee For Nominating Next Year's Officers And Directors

NOMINATING COMMITTEE members for the 1952 slate of A.F.S. officers and directors were chosen by the Society's Executive Committee and announced at the first meeting of the 1951-52 Board, July 27. Those on the Nominating Committee, who will meet in December, are:

Past President (1950-51) Walton L. Woody, National Malleable & Steel Castings Co., Cleveland—*chairman*.

Past President (1949-50) E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md.

Manley T. Brooks, Dow Chemical Co., Bay City, Mich.—representing Saginaw Valley Chapter and light metals.

A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.—representing Quad City Chapter and gray iron.

Martin E. Rollman, Cincinnati Milling Machine Co., Cincinnati—representing Cincinnati District Chapter and gray iron.

V. S. Spears, American Wheelabrator & Equipment Corp., Mishawaka, Ind.—representing Michiana Chapter and equipment.

Howard F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.—representing New England and education.

F. M. Wittlinger, Texas Electric Steel Casting Co., Houston—representing Texas Chapter and steel.

R. C. Woodward, Bucyrus-Erie Co., South Milwaukee—representing Wisconsin Chapter and steel.

The Nominating Committee was chosen in accordance with Article 10, Section 2, of the A.F.S. By-Laws from candidates proposed by chapters not represented on the Committee during the past two years. The names of two candidates were submitted by such chapters to the president of A.F.S. prior to July 1.

The Nominating Committee is required by the By-Laws to meet at least 90 days prior to the Annual Business Meeting and the names of the nominees selected by the Committee must be published in AMERICAN FOUNDRYMAN at least 60 days before the Annual Business Meeting held at the A.F.S. Convention.

"As the twig is bent, so grows the tree" is particularly true of the young engineer, who, if he is trained to follow good foundry safety practice as a matter of course during his formative years, will be of immeasurably greater value to the industry he is about to enter. In this article, the authors advocate making safety education a basic part of every engineering school curriculum, and cite fundamental rules of safety for every school foundry laboratory—rules which will instill safety-consciousness in men who may well be leaders of tomorrow's industry.

SAFE PRACTICES in SCHOOL

Lester M. Merritt* and Douglas C. Williams**

Ohio State University

INDUSTRY is becoming so safety conscious that almost every workman is given instruction regarding that company's safety policy at the beginning of his employment. Afterward, safety is constantly brought to his attention through payroll inserts, posters, safety meetings, safety committees, and many other industrial educational means. Management is alert to see that working conditions are safe and that workmen follow safe practices. This has come about through the realization by management that when the number of accidents is reduced, workmen feel more secure in their employment, resulting in a better mental attitude. This in turn brings better labor-management relations, as well as savings in cost of production which may be translated into more dividends or reduced product prices.

On the other hand, only the more alert educational institutions have made safety education a part of their curricula. Often the instructor in charge of a course where a hazard exists will indoctrinate the student in the specific hazard involved so that he will not be injured while in the school. Little attempt is made to equip the student with a realization that when he enters industry he will be responsible for the lives and limbs of his fellow workmen as well as his own.

Safety Should Be Part of Every Curriculum

No person can be happy if he realizes that the accident that caused John to lose his hand could have been avoided if proper educational precautions had been taken before John had been assigned to his task. This applies equally well to the woodworking shop, the machine tool practice and foundry laboratories, and to all other classrooms where students operate moving machinery, handle hot metal, or perform hazardous tasks.

Recently, a student in a well-known engineering school incurred a serious eye injury while operating a machine tool. Possibly that injury might have been avoided if the man had been required to wear goggles.

Since safety has been given such a major role in industry, every engineering student should be given instructions in safe working conditions and practices before he enters upon his engineering career. He will be expected to design equipment which will meet the requirements of safety codes. This equipment must be satisfactory from a production standpoint as well as safe in operation. When he assumes administrative duties, he is expected to be able to instruct men in safe methods of operation so that they will not incur injuries either to themselves or to fellow workmen.

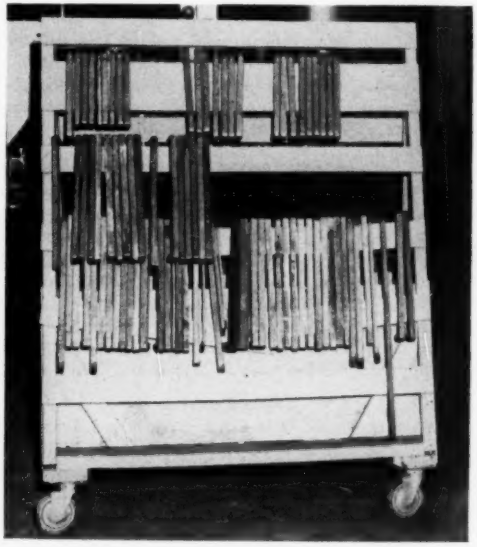
Paul N. Lehoczky[1] states that professional safety engineering is a distinct area of engineering which meets all of the basic requirements of the profession. In the light of his paper, safety engineering takes on an importance not hitherto enjoyed. This makes it imperative that both the designer and administrator have a knowledge of basic safety engineering. It also presents a pioneering field of specialization to the engineering student.

A.F.S. To Develop Safety Program

Walter L. Seelbach[2], National President, American Foundrymen's Society, stated that A. F. S. has accepted the obligation to establish a strong safety and hygiene program to develop recommended practices for safe, efficient and healthful foundry operations.

Safety engineering can be considered as the study and correction of the following phases of industrial life: (1) Unsafe conditions, (2) Unsafe practices,

Fig. 2—Rack for clamps, wedges and sprue covers eliminates hazard of students tripping over them.



*Lecturer in Industrial Safety, Department of Industrial Engineering, Ohio State University, and Industrial Hygiene Engineer, Division of Safety and Hygiene, Industrial Commission of Ohio.

**Associate Professor of Industrial Engineering in Charge of Foundry Area, Ohio State University.

Fig. 1—Quick action hose couplings are safe, eliminate undesirable hose lines on the foundry floor, and are economical because spare hose lines can be stocked for fast, economical hose replacement.

FOUNDRIES

(3) Fire and explosion hazards, and (4) Industrial hygiene hazards.

Usually unsafe conditions can easily be evaluated, since they can readily be seen by an experienced person. Unsafe practices, which are often the result of improper habits formed by the workmen, are much more difficult to correct. An educational program which will correct these habits requires psychology. Correction of fire and explosion hazards must be based on information available in reference texts and other sources. Industrial hygiene hazards require the attention of a specialist, although all engineers should have sufficient knowledge to recognize their presence.

The student can learn safety engineering by at least two methods. The first is by study of basic safety principles as a separate course of instruction. The second comes from practicing safe laboratory working conditions and procedures.

Suggested Industrial Safety Course

American Society of Safety Engineers[3] has outlined a suggested engineering college course in industrial safety. Two semester hours or three quarter hours are considered necessary for student indoctrination. Dr. Lehoczky outlined the basic safety engineering course now being taught in the Department of Industrial Engineering at Ohio State University. This course is required for all students in mechanical and industrial engineering, including foundry option and welding engineering. It is elective for all other students in the College of Engineering. During the four quarters of the 1949-1950 school year, approximately 200 students attended this course.

Ohio State University's basic safety course consists of: (1) study of a text book—*Industrial Safety* by Blake, (2) student plant safety survey, (3) student functional guard design, and (4) lectures by specialists in the fields of industrial medicine, industrial hygiene, compensation and fire prevention.

Text book study is augmented by four periods of National Safety Council slide films which present practical applications of safety principles. After the student has read the text, it is discussed in class. This is followed by a written examination. Students in safety engineering are either in their fourth or fifth year. Soon they will be graduated and will have to pursue new subjects for themselves. This method of presentation is aimed to give the student a better prospective of what will be expected of him in industry.

The safety survey assignment requires that the student establish contact with some industrial concern which will allow him to make such a survey. The student conducts the survey as if he were an employee of the company. He then takes his written report to the company for the purpose of discussion with plant management. In this way, the student obtains the viewpoint of management regarding his observations and management receives the opinion of an outsider concerning the conditions and practices in the plant. Generally it works to their mutual benefit.

While in the plant making his survey, the student should be on the alert for ideas for his functional guard design. The design is required to be "a positive device, inexpensive and simple[4]." It must not interfere with production but should enable the operator to increase his production by diminishing precaution required in performing his work. After completing his design, the student explains it to the class with the help of blackboard sketches and defends his method before the class. The class questions him regarding its functionability from any approach. This form of class criticism brings out other methods of guarding the same machine. Since the students select so many different types of machines for study, the guarding mechanisms presented vary over a wide range.

Course Features Lectures by Specialists

Lectures given by specialists make up about one-third of the course content. Compensation law is presented by an attorney who is a specialist on the subject. Industrial hygiene lectures from a medical point of view are given by a physician who is a specialist in industrial medicine. Industrial hygiene from the engineering approach is covered by a registered professional engineer who is a specialist in the field. These men are retained by the University as lecturers in the Department of Industrial Engineering.

The United States Navy fire film is used to present the causes of fire, its hazard with respect to materials, and methods of fire prevention. While many obvious facts are recorded on the film, there is much basic information relating to fires that is new to the student.

Consideration is given to the applications of basic safety engineering course concepts in the foundry laboratory. The instructional staff has the responsibility of maintaining the well-being of the student and safety is an important part of such well-being. If the student comes to the laboratory with a good mental attitude, he should leave for his next class without a tired or

disgusted feeling. If laboratory practices and equipment are unsafe, the department has failed in its responsibility to the student, as well as to the instructor who teaches the student during the next class hour.

In addition to serving as a place for students to learn casting manufacture, the basic safety course assigns special problems for reports. Students in classes in motion and time study and in production control use the laboratory for special assignments and for demonstrations. Here they witness safe practices and observe the relation between safe conditions, safe practices and economy of operation.

Students in industrial arts education are given a course in foundry science. While they are in the laboratory they are required to observe the same safe practices as engineering students. These students, who some day will be teaching shop courses in secondary schools, get their safety training only in the laboratories.

Before considering safety details at the Ohio State University Foundry Laboratory, certain conditions under which the laboratory is operated should be presented. A footnote in the *Engineering College Bulletin* suggests that students who need prescription safety glasses procure them before registering for any one of the three metal fabrication courses. Students who need only plain safety glasses may bring their own or purchase them in the department. At all times, in the three laboratories, students are required to wear their safety glasses. For the first violation the student is warned, and after compliance with the regulations, is permitted to continue work. For a second violation, the student is dismissed from the laboratory and failed for that period. Upon a third violation, the student will be failed in the course. No instance of a third violation has come to our attention. In all cases when students are melting and pouring an alloy, safety shields furnished by the university are worn over the safety glasses.

Students Learn Safety Equipment Location

Students, like industrial workmen, are not likely to determine the location of safety equipment. On an examination early in the quarter, there will be a question concerning the location of first aid kits or fire extinguishers or both. Being marked down on a question of this nature brings safety quickly to the student's mind. There are two first aid kits and three fire extinguishers in the laboratory. The instructional staff insists on treating every injury, no matter how slight, and to date no student has required treatment from the university clinic.

Since many days in early fall and late spring are very warm, heat prostration may overcome the student in the laboratory or it might reduce his efficiency in following classes. Salt tablets are delivered to each student by the instructional staff during these seasons. Occasionally a student states that salt tablets cannot be assimilated without ill effects, then no pressure is applied to make him take the tablets.

Students are not permitted to use compressed air to blow sand from their clothing. A first offense calls for a reprimand, a second violation brings dismissal from the course and a grade of failure is given. To the writers' knowledge, there has been no need to give the first reprimand.

Until October, 1949, each portable molding machine was connected to the compressed air line by means of a long hose. Coils of hose on the floor were constant sources of possible injury. Quick action hose couplings such as shown in Fig. 1 were installed at that time. This not only eliminates undesirable hose line, but is more economical, for spare hose lines now can be stocked and replacement requires only a few minutes. The instructional staff watches carefully to see that the laboratory floor is not only clean but free of items over which anyone can trip and be injured.

From the Hamilton Foundry & Machine Co., Hamilton, Ohio, we picked up the idea of using a clamp rack. Our model was constructed to hold clamps, wedges, and sprue covers (Fig. 2). Since these items are now kept in place, the possibility of tripping has been eliminated and only half the quantity of clamps, etc. are now stocked.

Industrial Color Is a Safety Measure

The foundry laboratory can be a cheerful place to work. Industrial color styling, using various paint colors, has been used on all machinery and walls of the laboratory. Machines are safer to handle when parts are color designated and the mental attitude of the operator is improved.

The color styling used for equipment is as follows: stationary parts—vista green, moving parts—focal beige, primary controls—focal yellow, secondary controls—focal orange, electrical and gas—focal red. The walls are painted focal beige except that vista green is used for the lower two feet.

Dropping bottom of the cupola is a hazardous operation which has been measurably improved. A long hook such as shown in Fig. 3 was constructed and is so arranged that the foundryman can dig at the bottom while standing to one side of the cupola. Four shields contain the "drop" of splashing slag and alloy. In addition, cupola tuyeres can be freed of slag after the drop without fear of solid pieces of slag falling and rolling out.

A hard hat should be provided for the maintenance man so that when repairing the cupola he is less susceptible to a head injury if something should become dislodged and strike him. Even work clothing costs money, and if the workman must furnish suitable clothing quite frequently, due to burning of what he is wearing, he can become an unhappy associate. Therefore bib type asbestos aprons are furnished to the maintenance man and instructors.

Asbestos quick-removal leggings are provided for everyone. The student is required to "bloom" his trousers over the leggings in order to prevent molten alloy from flowing between trousers and leggings.

Fundamentals of Foundry Safety

The A-B-C's of foundry laboratory safety for students are:

1. Carry molds by parts if possible when moving them to location for pouring.

2. Spread heap sand on cement floor before setting mold in pouring location.

3. Remember always that "personal caution is the greatest safeguard." A moment's carelessness or neglect

may mean disablement or injury to the student.

4. Seek first aid for even the "little scratch."

5. Do not wear loose fitting coats in the laboratory.

6. Remove all wrist watches, bracelets and rings when handling molten alloy.

7. Wear leggings over tightly-laced shoes and "bloom" trousers over top of leggings when handling molten alloys.

8. Wear eye shields over safety glasses when handling molten alloys and when chipping or grinding castings.

9. Never use cold or wet "skimmers."

10. Avoid throwing pieces of cold alloy into molten alloy.

11. Avoid using wet weights.

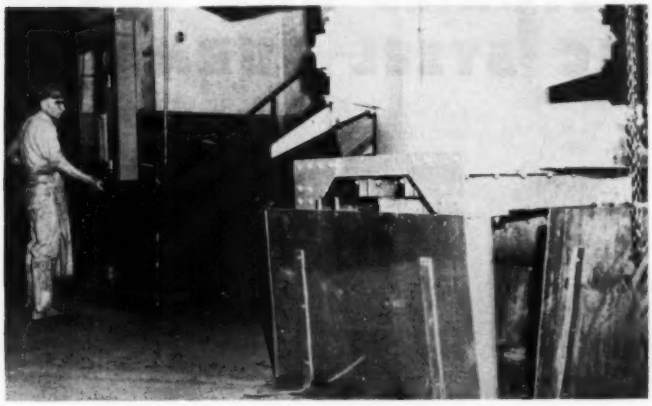


Fig. 3—To remove much of the hazard in dropping the cupola bottom at Ohio State's Foundry Laboratory, a long hook was devised for digging out "hung-up" cupola bottoms, permitting the operator to stand well out of the danger area. Four shields contain the "drop" of splashing alloy and slag. Tuyeres can be freed of slag, without solid pieces dropping and rolling out.

12. Never walk backwards when carrying ladles containing molten alloy.

13. Preheat metal pig molds before receiving leftover alloy.

14. When finished with the riddle, place it so that the other fellow cannot trip over it.

15. Pass on the side towards the ladle when carrying a ladle containing molten alloy.

16. Carry a ladle containing molten alloy behind you, never in front.

17. "Cut in" from in front with ladle slightly tipped toward the stream when catching molten alloy from tap or ladle.

Only One Accident in Three Years

Because Ohio State's instructional staff is safety conscious, only one accident has occurred in three years, when left over aluminum alloy was poured into a cold pig mold and an explosion resulted. The safety shield worn over safety glasses caught most of the flying alloy and the student received only two or three minor burns about the neck. This particular case showed that the shields, which are provided by the university, paid off.

The faculty and administration of Ohio State University have readily accepted a course in basic safety engineering, have provided much safety equipment and have insisted on the teaching of safe practices in the laboratory. The result of this attitude is reflected in the graduate's work when he takes his place in the metal castings industry.

Today, modern industry needs more men with a background in safety engineering. Industry needs men who will be aware of the hazards presented by unsafe conditions and unsafe practices, who will be cognizant of safety requirements when designing equipment, who will be able to guide the workmen into safe channels of production and who will remain sympathetic toward safety recommendations when they may become a part of top management. The engineering colleges of the nation must be alerted to the needs of industry in the field of Safety Engineering and must take measures to provide necessary instruction.

References

1. Paul N. Lehoczky, "The Relationship of Safety Engineering to Other Branches of Professional Engineering," National Safety Council, October, 1948.

2. Walter L. Seelbach, "The Road Ahead," Editorial, American Foundryman, December, 1950, P. 27.

3. "Industrial Safety for Engineering Students (A Suggested Engineering College Course)," American Society of Safety Engineers, Chicago.

4. Paul N. Lehoczky, "The Training of Students in Safety Engineering," *Engineering for Safety*, American Society of Safety Engineers, July, 1949.

Submit 1952 Convention Papers Early

AUTHORS OF TECHNICAL PAPERS expected to be presented at the A.F.S. International Foundry Congress & Show, Atlantic City, N. J., May 1 through 7, 1952, should plan now to meet the December 15, 1951, deadline set for receiving manuscripts.

Papers in manuscript form should be sent in duplicate as soon as possible to the Technical Director, American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. Manuscripts will be forwarded to the appropriate committee for review and possible scheduling for the 1952 A.F.S. International Foundry Congress & Show.

Intent to submit a paper can be indicated on the Offer of Technical Paper forms available from the Technical Director. Copies of the A.F.S. GUIDE TO AUTHORS are available on request.

Limiting factor in today's high-temperature steel metallurgy is refractories. Refractory manufacturers are well aware of this and their research departments are constantly on the lookout for ways to improve existing types, and for new oxides which may prove superior to present refractory materials. In this prize-winning article from Eastern Canada Chapter's Technical Papers Contest, the author describes properties and applications of basic refractory linings and patching materials for electric furnaces.

◀ *This refractory roof for a 1500 lb basic electric furnace, shown in the last stages of deterioration, outlasted two complete linings. Installed in a Canadian foundry on June 13, it was taken out on December 2 of the same year after enduring 445 heats. The linings averaged about 225 heats.*

BASIC REFRACTORIES AND SLAGS FOR ELECTRIC STEEL FURNACES

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District Sales Manager
Canadian Refractories, Ltd.
Montreal, Que., Canada

USE OF BASIC REFRACTORIES and basic slags in electric furnace steel melting permits the use of unselected scrap, since the basic furnace also refines the metal, in contrast to the acid electric furnace which does little more than melt the charge. The basic operation is more involved and requires the use of lime and mill scale in the charge. The mill scale tends to reduce the carbon content, while the lime protects the basic lining and at the same time takes up some sulphur and phosphorus.

Acid Refractories Used in Basic Roofs

Acid refractories are commonly used in basic furnace roofs for several reasons. First of these is that until recently basic refractories had insufficient strength under load and could not be depended upon to hold up in arched roofs. Secondly, basic refractories are several times as costly as acid refractories. Thirdly, acid roofs generally last about as long as basic wall linings, making it possible to do complete furnace rebuilds at one time.

A variety of acid refractories have been used successfully in roofs. The most commonly used is silica. Standard and super-duty silica brick are hard to beat for roof surface, provided the silica brick is heated and cooled slowly. Recently, fireclay refractories, particularly the super-duty types, have been used successfully, since they are resistant to temperature changes and do not spall to anything like the same degree as does silica.

Excellent results have also been achieved by using rammed material for center sections, and sometimes for complete roofs. Ramming mixes of mullite and 90 per cent alumina have worked out well, especially where production of expensive alloy steel warrants the high cost of these refractories. Although basic roofs are rare at present, they will eventually come into more widespread use because they are desirable metallurgically from the standpoint of no silica roof drip, resulting in less wall and bottom maintenance and better slag control.

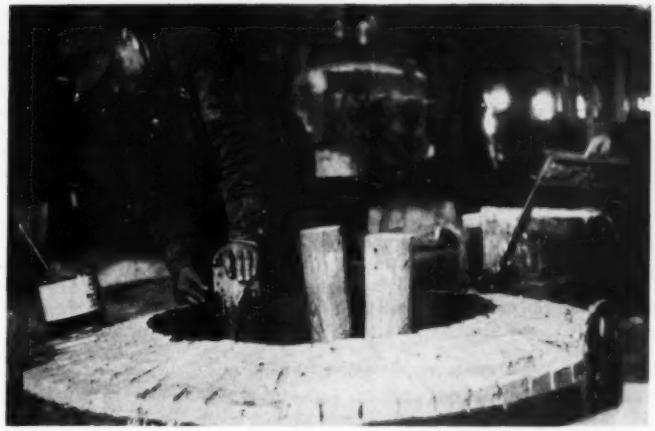
A roof is consumed in several ways, perhaps most commonly by spalling caused by rapidly changing temperatures which allow the silica brick to expand and contract, and to break off or spall at the surface. Direct heat melts the roof away, particularly if electrodes are not positioned properly, or if the furnace is overcharged. Melting is accentuated somewhat by lime dust blowing up to the roof and reacting violently with the silica brick. Some mechanical damage can occur if the roof is dropped roughly on the floor, or if the bricklayer drives his key brick home with a sledge—a method by no means uncommon. A rubber mallet rather than a metallic tool should always be used for this and all refractory bricklaying.

Spalling can be controlled by care being taken to insure gradual heating and cooling of the furnace. It is always necessary to balance time lost, i.e., production against refractory savings. Fast heating and cooling may gain time in furnace operation, but savings effected are offset by the more frequent need for refractory repairs.

Furnaces must not be overheated, and bath level must be kept to designed height. If a furnace is overcharged, slag climbs up the furnace walls and rapidly increases radiant heat, which in turn melts out the furnace roof.

Lump or coarse crushed lime must be used in the furnace—never powdered lime or lime hydrate. Some operators add lime before the charge, others after the first signs of a metal pool are seen. The use of lump lime minimizes dusting and improves furnace roof life.

Care is necessary in lifting off non-swinging roofs, and careful bricklaying is necessary to insure long refractory life. In the author's opinion, the best method of lining and roofing an electric furnace is to employ special shapes for the center and 9-in. series for the annular rings. This is open to discussion, however, since good results have been obtained using special roofs and 9-in. standard roofs.



Constructing a refractory roof for a small electric furnace. Workman is shown inserting a greased wooden mandril to insure correct placement of the electrodes. Acid refractories are more commonly used than basic refractories for roof construction because of their greater strength, economy and the fact that they last about twice as long as basic wall linings, making it possible to replace them both at the same time. This roof will have a rammed center section, saving the cost of cutting brick for tiny rings around electrodes.

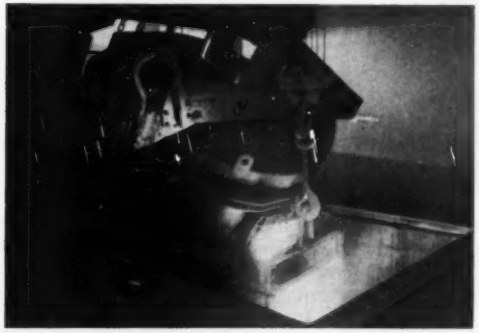
A number of different basic bricks can be used successfully in sidewall construction. Upper sidewalls, from the roof ring down to a course or two above the slag line, are now generally composed of chemically bonded metal-encased brick, or burned basic brick with or without steel casing. The slag line area is built of hard-burned high-magnesia brick, which seems to resist action of both basic and acid slags.

This method of using brick was arrived at only after considerable trial and error. At first, hard-burned basic bricks were used for the complete sidewall structure, but they failed because of excessive spalling. Chemically bonded bricks were then tried and were found to resist spalling to a much greater degree, but were poor in resistance to slag erosion and chemical attack, leaving the slag line with hard-burned magnesite brick. A further development was the use of steel cases which oxidized and held the brick in place, thereby improving spalling resistance and allowing the lining to be usable even when only a few inches thick. There is little danger of any part of it falling in, as the whole lining wears evenly and fuses.

The same factors that contribute to roof consumption cause wall destruction, although not to the same degree. For example, the chief cause of roof consumption is spalling, while the chief cause of wall consumption is chemical attack at the slag line. Usually this attack is from slags of an acid nature. When silica cannot be offset by the MgO or CaO in the slag, it will react with the basic brick it contacts at the slag line.

Eventually a deep cut develops at this spot, undermining the upper walls and causing them to fall in. To remedy this, more lime should be added and clean scrap should be used—not gates and risers covered with foundry sand. Silica brick dripping into the bath from the roof is another source of trouble, but this can be held in check with lower temperatures and normal charges.

A basic electric furnace shown in tapping position. Transfer ladle is under the spout in the pouring pit.



Temperature Changes Cause Spalling

Spalling, an important cause of sidewall consumption, usually occurs at the top of the wall, near the skew. This point is most affected by temperature changes that occur when the roof is swung off. All that can be done to remedy this is to keep the roof on as long as possible or get it back on quickly. Overcharging a furnace makes the slag line fluctuate and wears out areas higher up the wall.

Melting should never be done on the brick itself, but rather on the rammed basic bottom, which conforms to the shape of the sidewalls. This bottom can be maintained by adding granular refractories.

In the early days of steel furnaces, melting bottoms were made of grain magnesite mixed with iron oxide and burned in. Several years ago a Canadian company developed the first cold-setting rammed lining and this material is now used almost exclusively throughout North America. Basic ramming mixes are essentially ground magnesite, properly sized and blended with bonds. These compounds are mixed with very little water and rammed hard and dense into bottoms with air hammers. After ramming, a low but steadily increasing heat is applied until the moisture in the material is evaporated. Minimum drying time should be 12 hours, or longer if possible.

Basic bottoms last a long time—some have been

known to remain usable for years. Their failure results from improper maintenance such as poor cleaning practices, bad electrode control which might cause boring, general bottom erosion caused by steel currents in the bath, or holes under the carbons.

There are a number of materials that can be used to fill holes in banks and bottoms during production, and each operator seems to have definite ideas as to the efficiency of his own choice.

For basic furnaces, these refractories are of magnesite, dolomite or chrome, or a mixture of all three. A quick-setting grain magnesite, recently developed in Canada, does a fine job of filling up large holes in bottoms. This refractory sets almost immediately and requires little burning in.

Magnesite vs. Dolomite

The advantage of magnesite over dolomite is twofold: (1) magnesite will not hydrate, and (2) magnesite is much more refractory. However, dolomite materials are cheaper, and except for the new quick-setting magnesite, set faster than magnesite. Present practice is to use a mixture of magnesite and dolomite, the percentage of each depending upon the job. Usually, dolomite is used to maintain fairly steep banks, while magnesite is best for holes. Fairly recently, patching materials have been developed for use in refractory throwing guns. These materials, made from magnesite, dolomite and chrome, are effective in bank maintenance.

Several other basic refractories are utilized in electric steel furnace practice. One of these is high-temperature mortar for bonding basic brick not enclosed in a steel case and which is made from either magnesite or chrome, with added bonds. Another is a chrome base plastic used for lining ladles holding manganese steel. This refractory also takes care of tap holes.

The following is a summary of furnace operation variables affecting furnace life:

(1) The higher the proportion of scrap, the higher the temperature required for melting.

(2) Scrap must be clean and rust-free.

(3) Higher temperatures are required for small-sized castings.

(4) If the furnace is overloaded and charges are too large, metal line is raised nearer the roof, subjecting brick to greater heat.

(5) If heat is melted too rapidly, or is held too long, life of roof brick suffers. Brick life is seriously affected by length of time between heats.

(6) Irregularity in melting can be caused by unevenly distributed or too-large charge pieces.

(7) Fluid, foamy slag conducts more heat through to the metal and radiates less heat against the roof brick than does a thick, viscous slag. The heat penetrates with difficulty through the latter, and much of the heat is reflected against the roof.

(8) For best results, flux should be charged in lump form. If finely divided limestone is used, dusting may result, impinging on roof brick.

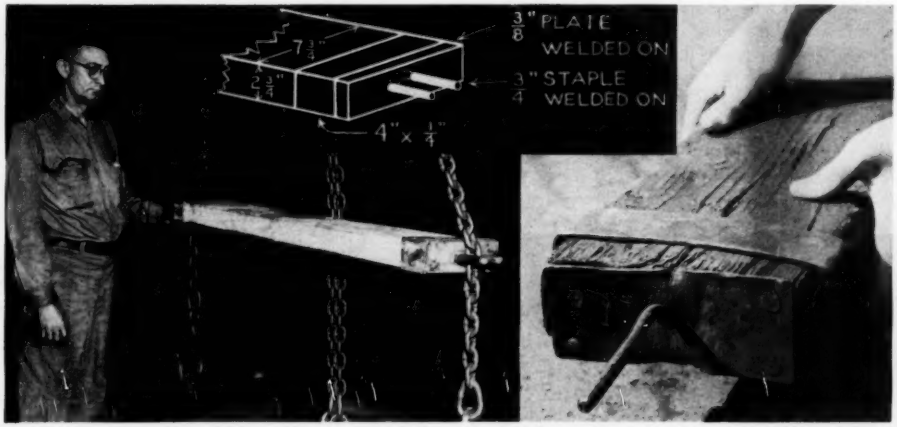
(9) If carbon is added directly under electrodes, arcing may take place, with bad effects.

(10) Close voltage control is important. Voltage should be tapered off toward end of heat.

(11) Carbon electrodes tend to become hotter than graphite electrodes, and the temperature of the roof brick is raised.

(12) Electrode coolers should be checked for leakage to prevent water contacting roof brick.

How To Make a Safer Lifting Chain Spreader



Devised by Ervin T. Nuetzel, blacksmith at Allis-Chalmers Mfg. Co.'s No. 1 Foundry, Milwaukee, and shown at left is claimed to be safer and easier to handle than the conventional single-rod lifting spreader shown at right. New U-shaped ¾-in. staple is welded to each end of the 7¾-in. wide by 2¾ in. thick spreader, with the open ends of the staples facing outward so that links fit between.

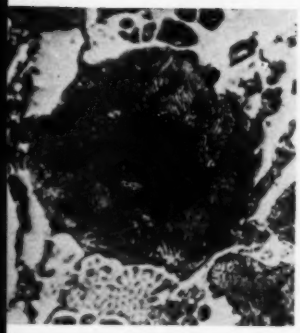


Figure 1. X650.

Some Experiments in PREPARING NODULAR IRON

W. P. Fishel, Professor of Metallurgy
Vanderbilt University
and
Robert C. Bramlette, American Cast Iron Pipe Co.

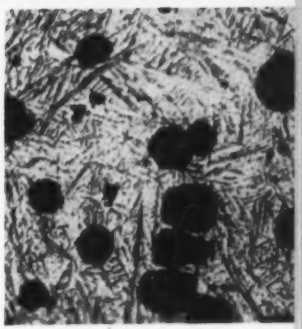


Figure 2. X140.

Recent experiments in preparing nodular iron reported in this article shed some light on the temperature at which the nodules begin to form and the phase from which they originate. Results of these experiments substantiate findings of previous researchers as to conditions needed for nodular iron production. They are, according to the authors: (1) a highly reducing metal as a reducing agent; (2) an iron composition that will readily graphitize; and (3) addition of about 0.5 per cent silicon as ferrosilicon after addition of one of the nucleating agents.

IN CONDUCTING EXPERIMENTS in preparation of nodular iron at Vanderbilt University, melts of foundry grade cast iron of approximately 800 grams were made in an induction furnace, using alundum or fire clay crucibles. Due to the small volume of the melts, all additions were made in the furnace. The melts were then poured, partly in sand molds, and partly in thick-walled steel molds. The latter will be referred to in this article as chilled castings, since they have matrices similar to white iron.

Completely nodular iron was obtained by adding 6 to 10 grams of pure magnesium, Dow metal C, and aluminum-magnesium alloys ranging up to 40 per cent. Some nodular iron was obtained by using calcium, calcium-iron alloy, and lithium, but only in the outer portion of the chilled castings.

An attempt was made to increase the magnesium's activity by alloying it with silicon, with aluminum, and with lithium. The silicon-magnesium alloys near a Mg_2Si composition were of no value. Lithium-magnesium and calcium-magnesium alloys seemed to burn more readily than did pure magnesium. Aluminum was found to cut down the burning tendency of magnesium. An alloy containing 20 per cent aluminum and 80 per cent magnesium was found to be very satisfactory since it is less violent in its reaction than pure magnesium and seems to enter the melt more readily. Information concerning melts that produced fully nodular iron is summarized in Table I.

TABLE I - COMPOSITIONS PRODUCING COMPLETELY NODULAR IRON

Melt	No. grams	Nodulizing Agent	% Mg Added	% TC	% Si	Remarks
21	8	Mg	1.0			
24	8	Dow Metal C	0.9	3.45	2.67	Hypoeutectic
28	10	40 Al-60 Mg	0.8	3.12	2.04	Hypoeutectic
30	8	20 Al-80 Mg	0.8	3.53	2.53	Hypereutectic
35	8	20 Al-80 Mg	0.8	3.47	3.02	Hypereutectic
39	8	20 Al-80 Mg	0.8	3.33	3.70	Hypereutectic

One hundred per cent nodular graphite was also produced in several high phosphorus irons. All sand castings contained typical nodules in a matrix composed of varying amounts of pearlite and ferrite. Usually each nodule was surrounded by a ferrite area. The chilled castings contained smaller graphite nodules increasing in size from the outside toward the center, in a matrix of white cast iron (cementite and pearlite). As shown in Fig. 1, the nodules were surrounded by pearlite and seemed to grow from solutions which formed pearlite at the lower critical (on cooling) temperature. Number and size of the nodules are shown in Table II.

TABLE II - AVERAGE NUMBER AND SIZE OF NODULES PER SQ CM

	Average Nodule Size X100 mm		Number per Sq Cm	
Melt	Sand Castings	Chilled Castings	Sand	Chilled
24	8.00	3.57	37	44
28	5.14	2.86	36	40
30	7.43	4.00	37.5	40
35	6.28	2.57	54	54
39	7.14		65.8	
39	quenched 5.43			
39	annealed 7.72			

Smaller size of the nodules in the chilled castings, and their presence in the outer portions of these castings indicate that nodules form early in the freezing process and that they grow at lower temperatures. In order to obtain further information on this point, a part of Melt 39 was poured in a preheated iron crucible which was quickly placed in a furnace held at 850 C.

Quenching and Annealing Chilled Castings

After one hour at this temperature, the crucible and contents were quenched in water. The quenched sample showed nodules in a matrix of martensite as shown in Fig. 2. The quenched sample was then annealed for one hour and furnace cooled. It was completely graphitized. This suggests that completely graphitized nodular iron could be produced by quenching chilled castings and annealing for a short time. Several melts were poured directly into water. Pellets 2 mm in diameter showed small nodules in a martensitic matrix. This seems to indicate that nodules do

not form by the decomposition of pearlite, since they appear very early in the freezing process.

Several x-ray diffraction patterns were made on nodules extracted from completely nodular iron by dissolution in dilute hydrochloric acid. These were compared with patterns of natural graphite. The patterns are similar as to number and positions of lines, but corresponding lines in nodular iron for equal exposures are very much weaker, which indicates that nodular iron is not completely or well crystallized.

Calcium Reacts with Carbon

During the experiments in which calcium was added, an odor resembling acetylene was noticed coming from the crucible and slag. This suggested that calcium was reacting with carbon in the cast iron, and possibly with phosphorus to form calcium carbide and calcium phosphide. Several melts were made; a sample was taken for analysis; then the calcium was added and a second sample was taken. These samples were analyzed for carbon and phosphorus. Small reductions in both elements were found after the calcium additions. These amounted to about 0.04 per cent phosphorus and 0.30 per cent calcium for a calcium addition of 10 grams per 800 grams of cast iron. All melts were from C, 4.00%; Si, 2.40; Mn, 0.40; S, 0.04; P, 0.04 base iron.

EDITOR'S NOTE: In producing nodular iron by means of magnesium, J. E. Rehder, Dept. of Mines & Technical Surveys, Ottawa, Ont., Canada, has encountered dephosphorization ranging from 22 per cent to 73.5 per cent of the phosphorus in the base iron (AMERICAN FOUNDRYMAN, May 1951, page 95).

1952 A.F.S. Apprentice Contest Opens

APPRENTICES FROM FOUNDRIES and patternshops in the United States, Canada, and Mexico will again match skills in the 29th A.F.S. Apprentice Contest which opens October 1. Competition is open in five divisions—metal patternmaking, wood patternmaking, and gray iron, non-ferrous, and steel molding. Patterns for the molding division and blueprints for the wood patternmaking division are supplied through A.F.S. Headquarters. For metal patternmaking, blueprints and rough aluminum castings will be furnished by the National Office.

Prizes of $100, $50, and $25 are awarded in each of the five contest divisions, and in addition, the first prize winners will receive round trip Pullman fare to and from Atlantic City, N.J., so they can attend the 1952 A.F.S. Convention, and International Foundry Congress and Show, to be held in that city May 1, through 7.

The contest is open to all apprentices taking regular training courses of not less than three years' duration and who are not over 24 years old on the day they prepare their entries. For veterans, the age limit is 24 years plus the length of service in the Armed Forces.

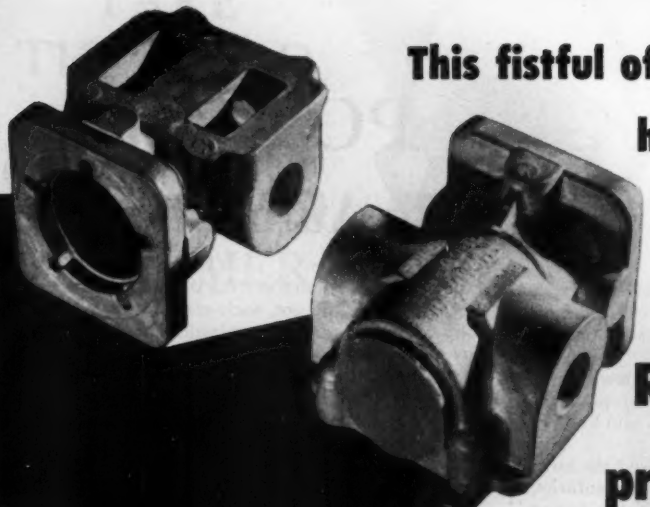
The contest remains open until March 15, 1952, and national judging will take place about April 1. Companies whose apprentices competed in previous years, and A.F.S. chapters are receiving notice of the opening of the contest along with regulations and suggestions for staging local contests.

Information on the 1952 A.F.S. Apprentice Contest is available from Jos. E. Foster, A.F.S. Headquarters, 616 S. Michigan Ave., Chicago 5, Ill.

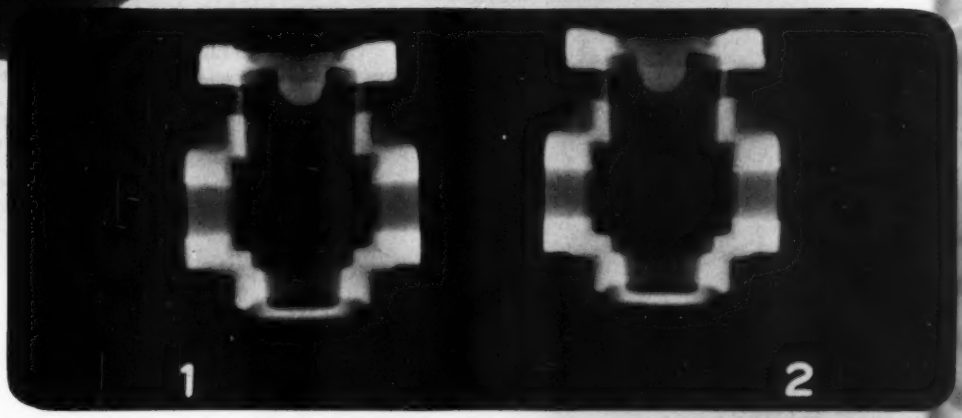
Battelle Institute to Construct Million Dollar Laboratory

Construction of the million dollar research laboratory shown in the architect's sketch above has been approved for Battelle Memorial Institute, Columbus, by the National Production Authority at the request of military and government agencies. Designed to step up Battelle's defense research activities by 15 to 20 per cent, the three-story structure will house two bays for pilot plant operations, 115 unit laboratories, and will provide 80,000 sq ft of work area. Battelle is the home of the A.F.S. Aluminum & Magnesium Division Research Project. Its staff members are frequent speakers at A.F.S. Conventions and chapter meetings and have written for AMERICAN FOUNDRYMAN *on a variety of topics.*

This fistful of pump has a plane-size job...



Radiography proves it sound



PERFORMANCE requirements for airplane parts run high. They must be strong and rugged. Even with light alloys, demand is for less weight.

Here is where radiography plays an important part. For the designer, knowing all castings used will prove sound, can plan to use the minimum of metal and still maintain needed safety margins.

Foundries making large or small castings—of light alloys or heavy metals—find it valuable to radiograph their castings. Then they know only highest quality work is released. Through pilot castings prior to large production runs, radiography frequently indicates ways in which methods can be improved to save time and increase yield.

Your x-ray dealer will gladly discuss how radiography can improve your plant operations. And if you wish, we will send you a free copy of "Radiography as a Foundry Tool."

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An American Relic Is Authenticated

More than 300 years ago, Landlord Thomas [illegible] son of Saugus, Mass., was given a three-legged iron cooking pot, cast from its first iron melt by his new tenant, the Hammersmith Iron Works. There was little to distinguish the Saugus Pot, as it is now known, from those used in every colonial home—except that it was the first casting made by the first successful foundry enterprise in the New World.

So goes the legend of the Saugus Pot and the birth of American ironfounding. For almost three centuries, the ruins of the Hammersmith Works have lain buried under the busy streets of Saugus, forgotten by all but a few historians. The Saugus Pot, gift of the Hudson family, reposed in the public library in nearby Lynn, Mass., where many scoffed at its accompanying legend, "The first casting made in America—1642." Admittedly, dozens like it were for sale in antique shops.

Then one day a vacationing steelman, poking around in the ruins of the Hammersmith Works, found a few pieces of iron and some ore. Recalling the hotly-debated authenticity of the Saugus Pot, he reasoned that if its composition included the same curious combination of elements as found in his discoveries, the legend of the pot would be substantiated.

The pot, with the samples of ore, broken castings, and nails found at the iron works site, was taken to the New England Spectrochemical Laboratories at Ipswich for spectroscopic analysis. Minute drillings were taken from the pot's legs and from the specimens.

First to go under the spectroscope were specimens [illegible] ore, then samples from the relics, and finally, specimens from the pot. Such components as nickel, copper, and tungsten were recorded for each sample. Tests completed, the reports were compared. Pot, ore, and relics tallied in quantity and variety of metals present. "On the basis of our examination," the laboratory reports, "we have no reason to doubt the authenticity of the Saugus Pot." Thus, the Saugus Pot becomes one of the earliest scientifically authenticated iron articles made in the New World.

The old ironworks in which the Saugus Pot was cast occupies a prominent place in American industrial heritage. Established about 1646 on the Saugus river, 10 miles north of Boston, it employed more than 100 men to produce both cast and wrought iron from bog ore, turning out more than a ton a day. The iron was fashioned into pots, pans, nails, chisels, bolts, etc.

Organized and financed by Englishmen, the Hammersmith Iron Works flourished for a half-century, before unfavorable legislation and lack of materials closed it down. It remained forgotten until 1942, when the still-standing ironmaster's house was purchased for removal to Henry Ford's Dearborn Village.

Saugus townspeople then became aware that a priceless bit of Americana was being removed from their city. They formed the First Iron Works Association, raised funds and repurchased the house, and today this group of public-spirited townspeople and industrialists from all over the country is completely restoring the old iron works, to preserve it as the "Cradle of American Industry."

Technician Sophie Delekta of New England Spectrochemical Laboratories makes a spectroanalysis of the Saugus Pot as Professor E. N. Hartley, Massachusetts Institute of Technology, observes the screen. Professor Hartley has undertaken historical research for the First Iron Works Association to aid in authentic reconstruction of the Hammersmith Iron Works, now going on at Saugus, Mass., where the Saugus Pot was cast some three centuries ago. The Pot, back in its accustomed place in the Lynn (Mass.) Public Library, is, as a result of these tests, now recognized as one of the first iron articles made in America.

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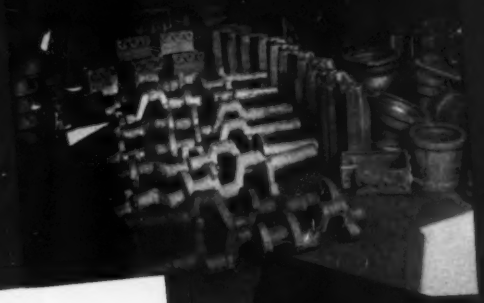

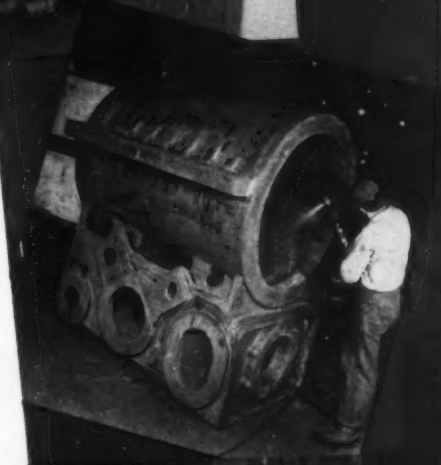

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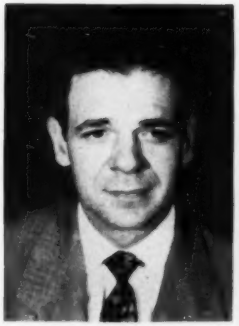

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FOUNDRY Personalities

T. W. Merrill has been appointed chief metallurgical engineer for Vanadium Corp. of America, and has been transferred from the company's Bridgeville, Pa., plant, where he was metallurgical engineer, to

T. W. Merrill

the main offices in New York. After graduating from Yale University in 1936, Mr. Merrill worked for United States Steel Co., prior to joining the Vanadium Corporation.

Raymond L. Collier has been named executive secretary of the newly formed National Association of Aluminum Distributors. Mr. Collier was formerly executive secretary of the Gray Iron Founders' Society and of the Steel Founders' Society of America. He will have his offices at 905 Midland Bldg., Cleveland.

Thomas E. Eagan, formerly head of Cooper-Bessemer Corp.'s foundry laboratories, has been named to the newly created position of research metallurgist for the company. Mr. Eagan, a National Director of A.F.S., in his new capacity will develop new engineering metals and processes for the foundry. Holder of degrees from Columbia University and the Missouri School of Mines, Mr. Eagan has been with Cooper-Bessemer since 1934. He is succeeded as head of foundry research laboratories by **W. R. McCracken,** who will also be in charge of materials control in the company's Grove City and Mt. Vernon foundries.

James T. MacKenzie, technical director, American Cast Iron Pipe Co., Birmingham, Alabama, and a National Director of A.F.S. was recently awarded the Herty Medal for outstanding contributions to metals research by Georgia State College for Women's Chemistry Club. The award is administered by the Georgia Section of the American Chemical Society.

W. E. Madden, formerly vice-president, George Haiss Mfg. Co., Inc., New York, has been named director of sales for those Pettibone Mulliken subsidiary companies whose products are sold to the materials

W. E. Madden

handling, processing, road building and construction fields. Named assistant director of sales is **J. M. Hume,** formerly sales manager for Universal Engineering Corp., Cedar Rapids, Iowa. Both will make their headquarters in Chicago. Unaffected by

J. M. Hume

the new Pettibone Mulliken sales setup are the Beardsley & Piper, and Railway Track Materials divisions.

Warden F. Wilson, general sales manager of Lebanon Steel Foundry, Lebanon, Pa., was recently elected president of the Alloy Casting Institute. Other officers elected at the Institute's Annual Meeting at Hot Springs, Va., are: **H. T. Harrison,** vice-president, Duraloy Co., Scottdale, Pa., vice-president; **E. A. Schoefer,** re-elected secretary and treasurer; and **G. A. Baker,** vice-president, Duriron Co., Inc., Dayton, Ohio, and **J. S. Wooters,** General Alloys Co., Boston, directors. Mr. Wilson was at one time assistant to the works

W. F. Wilson

manager at Indiana Harbor, Ind., manager of the Pittsburgh Works, and manager of the Verona Works of American Steel Foundries, before becoming chief sales executive of Lebanon Steel Foundry.

Fitz Coghlin, Jr., until recently quality control manager for Albion Malleable Iron Co., Albion, Mich., is now plant manager, Dock Foundry Co., Three Rivers, Mich. A graduate of the University of Texas, Mr. Coghlin was employed as metallurgist for Arcade Malleable Iron Co., and subsequently as metallurgist and quality control manager for Albion Malleable Iron Co. He is a past chairman of the A.F.S. Central Michigan Chapter and has served on several technical committees of ASM and A.F.S.

Harry Czyzewski has resigned his assistant professorship of physical metallurgy at the University of Illinois to devote his full time to his consulting service, Metallurgical Engineers, Inc., Portland, Ore. Mr. Czyzewski had been at Illinois as a faculty member and to work out advanced metallurgical problems.

Charles W. Guptil succeeds **Henry E. Balsley,** retired, as St. Paul representative of Eclipse Fuel Engineering Co. of Rockford, Ill.

Robert E. Kroc has been appointed assistant sales manager for the Fahralloy Co., Harvey, Ill. Mr. Kroc began in the company's pattern loft, leaving there to serve in the Navy in World War II, and

returning as a draftsman and engineer. He was later made a sales representative for the company's products in Michigan, northern Illinois and Iowa.

George C. Evans has been named supervisor at American Brake Shoe Co.'s Electro Alloys Division, Elyria, Ohio.

A. C. Towne, Jr., has been elected president and **William Jarvis** general manager of the Michigan Oven Co., Detroit. Mr. Towne, a founder of the company, was formerly Buffalo district manager, and Mr. Jarvis was chief engineer of the Detroit Sheet Metal Co.

David C. Ekey succeeds the late Clifford W. Morissette as instructor in Pennsylvania State College's Department of Industrial Engineering and will be in charge of foundry option. Mr. Ekey recently completed work on an advanced degree at Ohio State University.

John A. Sharritts will head the newly organized John A. Sharritts Co., Cleveland manufacturers' agents. The new firm will take over agencies formerly held by the late Russell F. Lincoln for International Molding Machine Co., Modern Equipment Co., and Claude B. Schneible Co. Mr. Sharritts, former foundry superintendent at Westinghouse Electric Corp.'s Cleveland plant, will make his headquarters at 1273 West 108th St., Cleveland.

John B. Connally, Jr., has been named a director, and **Walter T. Moreland** vice-president in charge of sales for Lone Star Steel Co., Dallas. Mr. Connally's

W. T. Moreland

career includes a law degree from the University of Texas, admission to the Texas Bar in 1939, combat duty with the Navy in World War II, organization and current presidency of Radio Station KVET, Austin, administrative assistantship to Texas' Senator Johnson in 1949, and membership in an Austin law firm. Mr. Moreland was promoted to vice-presidency after serving Lone Star as sales manager since May 1, 1950. Prior to joining Lone Star, Mr. Moreland did sales promotion work for Radio Corp. of America, and was regional manager for the L. E. Waterman Co., and Noblitt-Sparks Industries. He served as an instructor pilot in World War II.

Cecil McClelland, crane operator in Hunt-Spiller Mfg. Co.'s foundry, Boston, made news headlines recently in the *Boston Daily Globe* when he delivered his wife of a child for the second time in two years. This time, Mr. McClelland, 23, handed the hastily-summoned doctor a healthy infant. The doctor checked the newborn baby, pronounced mother and child in fine condition, and whisked both off to Boston's City Hospital. McClelland received his "doctorate" the first time in an identical case in November, 1949, when his wife, Mildred, 22, and the stork outguessed the local doctor.

Ben F. Sweet, formerly of Morse Chain Co., Ithaca, N. Y., has been placed in charge of Sprout, Waldron & Co., Inc.'s new modernization program for its ferrous foundries.

Eugene W. Smith has left Western Materials Co., Chicago, to act as national distributor of Sil-Gan, a South Dakota quartzite ganister. He will also handle other foundry supplies from his office at 5344 W. Adams St., Chicago 44.

(Continued on Page 87)

THIS MONTH'S AUTHORS

Fitz Coghlin, Jr., author of *"Rigid Controls and Standards Improve Duplexing Operations,"* Page 24, was recently named manager of the Dock Foundry Co., Three Rivers, Mich. A graduate of the University of Texas in 1941, Mr. Coghlin joined Arcade Malleable Iron Co., Worcester, Mass., that same year. In 1945 he joined Albion Malleable Iron Co., Albion, Mich., as metallurgist, leaving there to become a foundry consultant. He is past chairman of A.F.S. Central Michigan Chapter.

Roy W. Schroeder, who in his article, *"Review of 1951 A.F.S. Apprentice Contest Entries,"* Page 40, this year as in past years critically reviews entries in the Contest, is chairman of the A.F.S. Apprentice Contest Committee. Mr. Schroeder's long career in the foundry industry has been divided between its operating and educational phases. Starting as an apprentice molder in 1915, he has since been a molder, timekeeper and assistant superintendent in several Illinois foundries and has taught foundry at Chicago's Washburne Trade School and at the University of Illinois Navy Pier Branch, Chicago, where he is assistant professor of foundry and pattern laboratory.

A. H. Thomson, author of *"Basic Refractories and Slags for Electric Steel Furnaces,"* Page 52, is district sales manager for Canadian Refractories, Ltd., Montreal, Que., Canada. Mr. Thomson's paper was one of the top prize winners in the A.F.S. Eastern Canada Chapter's annual Technical Papers Contest.

Harry W. Dietert, author of *"Controls for Green Working Strength of Molding Sands,"* Page 32, is a newly elected National Director of A.F.S. and is an A.F.S. Wm. H. McFadden Gold Medalist. Mr. Dietert received a B.S. from Iowa State College and his Master's degree in mechanical engineering from the University of Illinois. He joined United States Radiator Corp. in 1923 as plant engineer, and was chief engineer from 1932 to 1938 and consulting engineer from 1938 to 1940, when he left to form his own foundry sand testing equipment firm, the Harry W. Dietert Co., Detroit. Mr. Dietert has been extremely active in A.F.S. technical committee work and in 1940 was awarded the A.F.S. McFadden Gold Medal for his work in promoting interest in sand control, research and technology.

Lester M. Merritt and Douglas C. Williams, co-authors of *"Safe Practices in School Foundries,"* Page 48, presented the paper at a recent meeting of the Foundry Educational Foundation. Mr. Merritt, who is industrial hygiene engineer, Division of Safety and Hygiene, Industrial Commission of Ohio, is also a lecturer in industrial safety at the Ohio State University, where he collaborated with Dr. Williams, associate professor of industrial engineering in charge of foundry area. Dr. Williams is a former A.F.S. Research Fellow, working on the A.F.S. Sand Research Project at Cornell University, and has been faculty advisor to the A.F.S. Ohio State Student Chapter since its inception.

Waite P. Fishel and **Robert C. Bramlette,** co-authors of "Some Experiments in *Preparing Nodular Iron,*" Page 55, at the time the article was written were professor of metallurgy and graduate student, respectively, at Vanderbilt University. Professor Fishel holds an A.B. from Ohio University, and an M.S. and Ph.D from Iowa State College, where he served as graduate assistant for four years. He came to Vanderbilt University in 1923 as an assistant professor, and is today professor of metallurgy there. Mr. Bramlette, who has now left Vanderbilt University, held the Eagan Fellowship in metallurgy there. The Eagan Fellowship was established by the American Cast Iron Pipe Co., Birmingham, Ala., in honor of its late president. Mr. Bramlette is now employed by that firm.

Humphrey J. Millward, author of *"Mg-Zr Casting Alloys Attain High Strength-Weight Ratios,"* Page 44, is chief metallurgist for Sterling Metals, Ltd., Coventry, England, where he began work shortly after receiving a degree in metallurgy from Coventry Technical College in 1923. He has been, successively, metallurgical chemist (1923-33), assistant manager of magnesium foundry (1933-38), metallurgist in charge of light alloys (1935-45), and chief metallurgist since that time. Mr. Millward is a member and has served on several committees of the British Non-Ferrous Metals Research Association, British Standards Institution, Light Metal Founders Association and Birmid Industries Assn.

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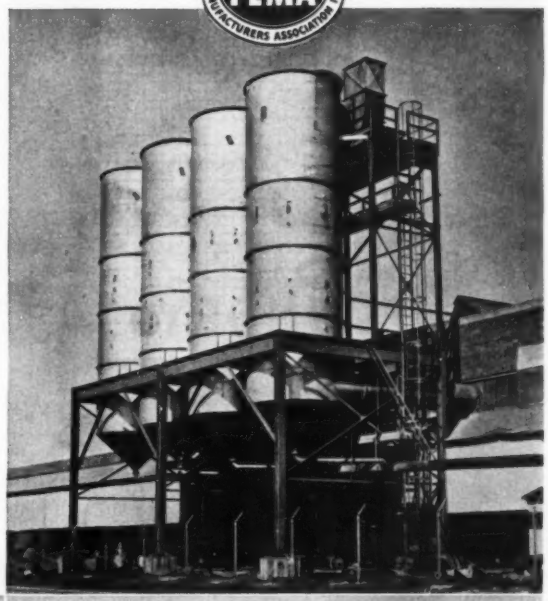

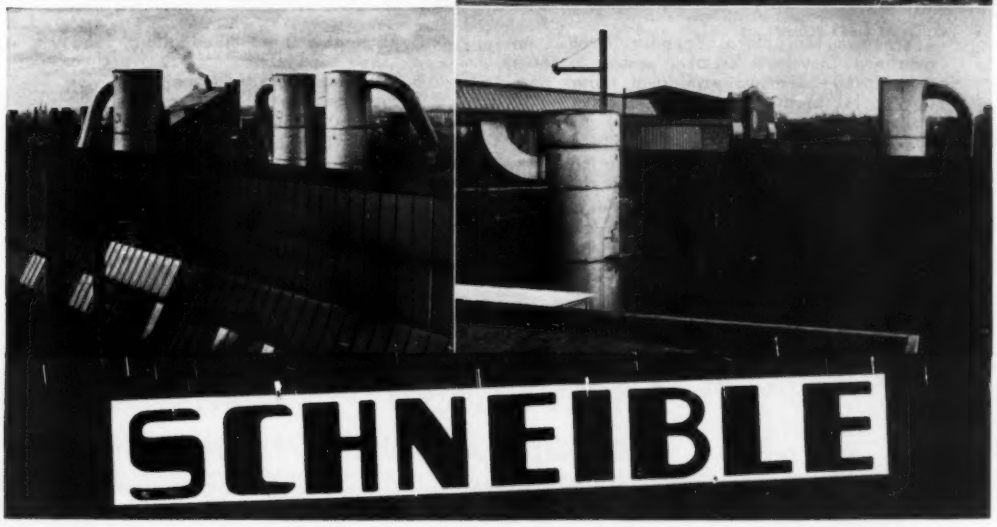

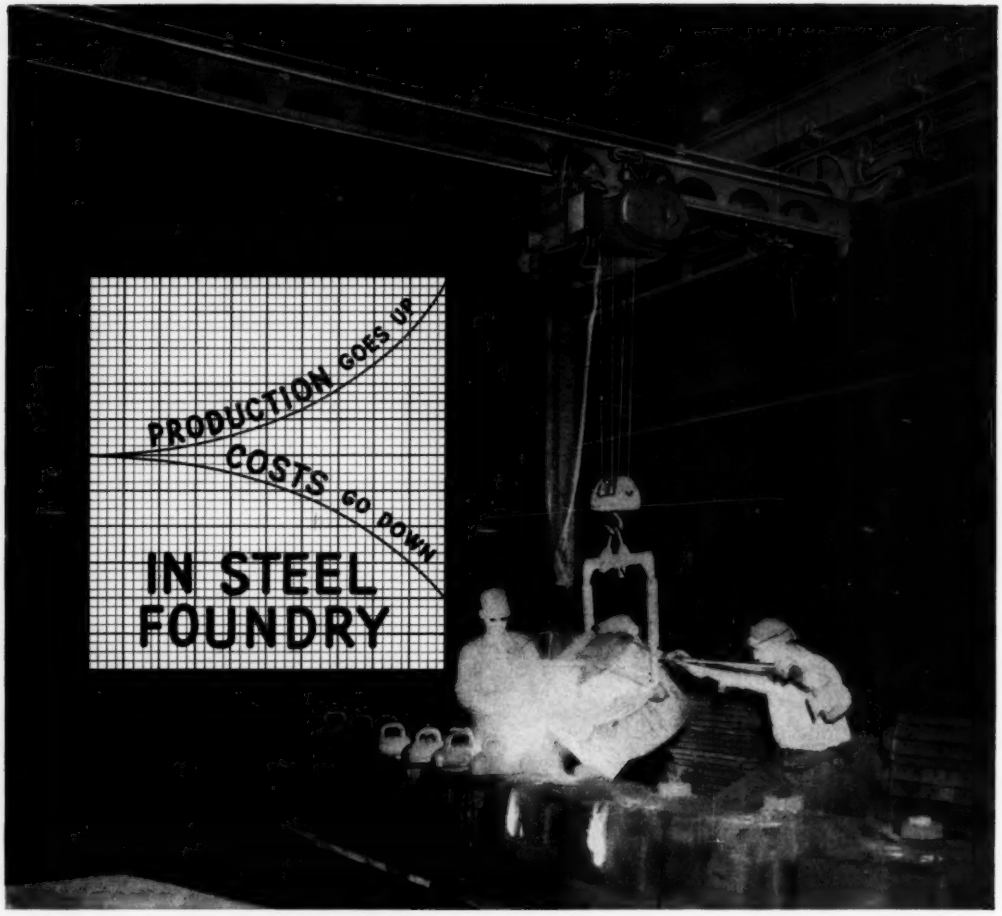

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BOOK REVIEWS

Casting Design and Production

Fundamentals in the Production and Design of Castings, by Clarence T. Marek. 383 pp. Indexed. Illustrated with photographs and diagrams. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $4.00. (1950).

Relationship between casting design and production for foundry economy is stressed in this volume, which analyzes the skills and practices involved in castings production. Discussed in this book are the foundry industry as a whole, jobbing shop molding, clay bonding, patterns and cores, and new non-destructive testing methods. Also given is information on properties and uses of ferrous and non-ferrous metals, and data on the melting of cast metals.

Cast Iron Testing

ASTM Symposium on Testing of Cast Iron With SR-4 Type of Gage. 92 pp. Illustrated with photographs, photomicrographs and diagrams. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $1.65. (1950).

This Symposium, presented at ASTM's 52nd Annual Meeting, deals with SR-4 gage testing of automotive cylinder blocks, crankshafts, engine frames and cylinders; diesel cylinder blocks, heads and pistons; cast iron beams; valve assemblies, parts and sleeves; cast iron aerating trays; punch press frames; tractor, textile machinery and railroad castings. Methods are outlined for exploring stress distribution in castings by the strain-resistance wire gage system.

Engineering Metals

The Behavior of Engineering Metals, by H. W. Gillett. 395 pp. Illustrated with photographs, photomicrographs and diagrams. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. $6.50. (1951).

Published posthumously, this work of the late Dr. H. W. Gillett of Battelle Memorial Institute is designed to help the non-specialist understand factors influencing selection of the right metal or alloy for a given use. Beginning with an introduction to basic metallurgical concepts, the book deals with each major engineering metal or alloy, in order of commercial importance. Sections are also devoted to special considerations that may influence metal selection for a given job, such as machinability, special fabricating techniques, corrosion, heat resistance, etc.

Hot Dip Galvanizing

Galvanizing (Hot Dip), by Heinz Bablik. 502 pp. Illustrated with diagrams, photomicrographs and charts. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.00. (1951).

Manager of his own galvanizing factory and a lecturer at the University of Vienna, the author uses this unusual combination of experience to point out that theory is the best guide to practice. In this volume, he explains the close connection between theory and practice in such aspects of hot dip galvanizing as scale, pickling, fluxes and galvanizing.

German Foundry Directory

Addressbuch der Deutschen Giesserei Industrie. 478 pp. Printed in five languages —English, French, Spanish, Italian and German. Published by Giesserei-Verlag, G.M.B.H., August-Thyssen Str. 1, Dusseldorf, Germany. $3.60. (1951).

This comprehensive listing of all West German foundries, classified by types of metals cast, gives directions in five languages on how to use the Directory—(1) to find what type of casting a certain foundry produces, (2) to locate all foundries in a given city or area, (3) to locate foundries producing certain types of castings, for example, piston rings, and (4) to locate producers of foundry supplies and equipment. Foundries are classified both regionally and alphabetically and such information is given on each as: address, products, executives, production capacity, whether captive or not; and with or without own pattern shop, molding shop and machine shop.

Sand Control

Foundry Sand Control, by W. Davies. 212 pp. Illustrated with photographs, charts and diagrams. Published by United Steel Companies, Ltd., 17 Westbourne Rd., Sheffield 10, England. $6.00. (1950). Available in the United States through Ceramics Publishing Co., Inc., 421 Parker St., Newark 4, N. J.

Written by a geologist-foundryman, this volume attempts to correlate the essentials of a wide variety of literature on foundry sand control and to emphasize the close relationship between geological characteristics of molding sands and bonding clays and their behavior in foundry practice.

Included in text are chapters on the Constitution of Clay-Bonded Molding Sands, Characteristics of Sand Grains, Characteristics of the Clay Bond, Preparation of Molding Sands, Shaping of the Sand, the Mold Surface, Strength of Molding Sands, the Foundry Sand System, Selection of Foundry Sands, Selection of Bonding Clays, and the Future of Foundry Sand Control.

Industrial Ventilation

Manual on Industrial Ventilation. 162 pp. Illustrated with charts and diagrams. Published by Illinois State Health Department, 1800 W. Fillmore St., Chicago 12. $3.00. (1951).

Manual contains most recent data on industrial exhaust ventilation and is a report of the American Conference of Governmental Industrial Hygienists. In loose-leaf form for yearly revision, the Manual contains more than 60 full-page hood designs, extensive data on special applications, and references for readers interested in more detailed information.

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	Grade	Tensile strength, psi	Yield strength, psi	Elongation per cent	BHN	Usual condition
A	90-65-02	95/105000	70/75000	2.5/5.5	225/265	As-cast
B	80-60-05	85/95000	65/70000	5.5/10.0	195/225	As-cast
C	60-45-15	65/75000	50/60000	17.0/23.0	140/180	Annealed
D	80-60-00	85/95000	65/75000	1.0/3.0	230/290	As-cast

A Pearlitic in structure. Provides good mechanical wear resistance.

B Pearlitic-ferritic in structure. Provides strength and toughness combined.

C A fully ferritic structure usually obtained by short anneal of either (A) or (B). Provides optimum machinability and maximum toughness.

D Higher phosphorous content than preceding grades, also higher manganese. Provides high strength and stiffness, but only moderate impact strength.

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1. Its elastic modulus, about 25,000,000 psi, is virtually unaffected by composition or thickness . . .

2. It can provide a chilled, carbidic, abrasion-resistant surface supported by a ough ductile core. No other single material can combine these properties . . . its only counterpart being a tough material coated with a hard welded overlay.

3. As-cast ductile iron of 93,000 psi tensile strength has the same machinability rating as gray iron with a strength of 45,000 psi.

4. Annealed ductile iron can be machined at a rate 2 to 3 times that of good quality gray iron.

5. It can be satisfactorily welded.

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Automotive, agricultural implement, railroad and allied industries apply ductile iron, as-cast and heat treated, in components too numerous to detail.

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Foundrymen and their friends photographed during Chicago Chapter's Picnic included, left to right, Picnic Guests Al Regulbrugge, Ray Wilkes and Elmer Zuelke; John Behen, National Carbon Co., horseshoe pitching chairman; Robert Gaskill, Wisconsin Steel Foundries; Eric Radtke, International Harvester Co.; Dan Dugan, Mexico Refractories Corp.; and William Hofert and Harold Hodges, both of International Harvester Co., Chicago. (Photograph courtesy of Chapter Director W. D. McMillan, International Harvester).

CHAPTER ACTIVITIES NEWS

Central Michigan

Thomas Lloyd
Albion Malleable Iron Co.
Chapter Chairman

PRE-SEASON directors and officers meeting of the Central Michigan Chapter was held at Duck Lake, Mich., in Albion Malleable Iron Co.'s summer cottage July 16.

Between sessions of planning programs and special events for the chapter's 1951-52 season, officers and directors relaxed with a ride on the H.M.S. Fiddle Faddle, a unique boat made from an Army Surplus rubber bridge pontoon by Donald Champion of Albion Malleable.

Present at the meeting were: Chairman Thomas Lloyd. Albion Malleable Iron Co.; Vice-Chairman Austen J. Smith, Michigan State College; Secretary-Treasurer Richard Moore, Foundries Materials Co.; and Directors Donald Champion, Albion Malleable Iron Co.; Palmer Coombs, Riverside Foundry & Galvanizing Co.; William Robb, A. P. Green Fire Brick Co.; Jack Secor, Hill & Griffith Co.; David Boyd, Engineering Castings Co.; Roy Miller, United States Foundry Corp.; and Past Chairman Charles C. Sigerfoos, Michigan State College.

Western Michigan

Charles H. Cousineau
Carpenter Bros., Inc.
Publicity Chairman

MAY MEETING of the chapter was held at the Cottage Inn, Muskegon, with O. J. Myers, Archer-Daniels-Mid-

Following Oregon Chapter's regular meeting on June 18, the Carborundum Company was host to the chapter on a guided tour of its abrasives plant at Vancouver, Wash. Also featured was a Carborundum Co. film showing development and making of abrasives. Photograph courtesy Norman Hall, Electric Steel Fdy. Co.

This photo, taken last term at Oregon State College, shows A.F.S. Student Chapter members, left to right, W. D. Macomber, L. J. D'Assissi, K. J. Allen, A. M. Thompson and R. R. Johnson pouring aluminum into molds in the College's new Metals Casting Laboratory. (Photo by Clarence Palmer).

Past Chairman Fred J. Pfarr, Lake City Malleable Co., left, and A.F.S. National President Walter L. Seelbach, Superior Foundry, Inc., both of Cleveland, were snapped in an informal moment at Northeastern Ohio Chapter's May meeting by Photographer S. N. Farmer, Sand Products Corp.

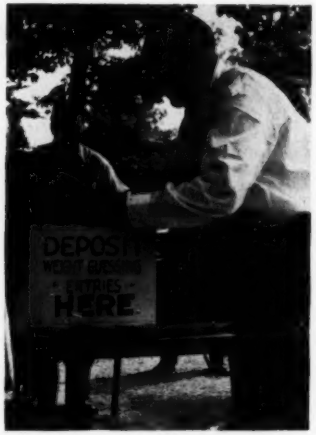
There was action and plenty of it during the sack race at Eastern New York Chapter's First Annual Picnic at Endries Willow Grove Inn June 16.

land Co., Foundry Products Division, speaking on *"Core Sand and Binders."*

Mr. Myers showed slides of operations at Archer-Daniels-Midland's research laboratory, and others depicting the various types of binders on the baking cycle. Mr. Myers gave a very informative talk on the "why's" and "wherefor's" of the action and effects of several types of binders and some core sands on foundry practice.

Designated "Past Chairmen's Night," the meeting was one of the largest of the season. Featured on the program was presentation of bronze plaques to all the chapter's past chairmen and to George W. Cannon and A. E. Jacobsen for their outstanding work on behalf of the chapter in the past.

The plaques were cast by students of the Hackley Manual Training High School, Muskegon, under the direction of Instructor Adrian Archambault. This gives the plaques an added sentimental value, since the chapter was instrumental in reviving foundry courses at Hackley School after they had been discontinued for more than two decades.



One of several hundred foundrymen who tried their skill at Chicago Chapter's casting weight guessing contest at the chapter's Annual Picnic. (photograph courtesy of Deming H. Lucas, foundry manufacturers' representative.)

Twin City

J. D. Johnson
Archer-Daniels-Midland Co., Foundry Products Division.
Chapter Reporter

SIXTH ANNUAL GOLF PARTY of the Twin City Chapter, held at the Midland Hills Country Club, was attended by well over 200 members and their

guests, who enjoyed a splendid afternoon of golf and an evening of eating, prizes and entertainment. The party was arranged by Chairman Michael Flaaten and his entertainment committee.

Trophy for member low gross golf score was awarded to Dean Thom of the E. R. Frost Co. Low gross for the afternoon, 73, was turned in by Leo Johnson of Minneapolis-Moline Foundry Co. Eight blind bogey prize winners had net scores of 76. Many beautiful prizes were awarded to the golf winners and many more were later given out during the evening.

Oregon

Norman E. Hall
Electric Steel Foundry Co.
Chapter Reporter

FOLLOWING the chapter's regular dinner meeting June 18, Carborundum Co. showed a film on the development and production of abrasives, and later was host to the Chapter on a tour of the company's Vancouver, Wash., plant.

Chapter members were divided into small groups and shown through the raw materials plant by well-informed guides chosen from plant personnel.

Following the tour, each member and guest was given samples of silicon carbide and an envelope containing a package of flint paper and a carborundum stone. The chapter wishes to ex-

Photographed during Central Michigan Chapter's Director's meeting on July 16 were, left to right, Secretary-Treasurer Richard Moore, Foundries Materials Co.; Chairman Thomas Lloyd, Albion Malleable Iron Co.; and Vice-Chairman Austen J. Smith of Michigan State College, E. Lansing.

Life on the briny deep aboard H.M.S. Fiddle Faddle provided a welcome diversion during Central Michigan Chapter's director's meeting on July 16. The meeting was held at Albion Malleable Iron Co.'s cottage on Duck Lake, where one of the familiar sights is the unique H.M.S. Fiddle Faddle, built by Chapter Director Don Champion of Albion Malleable Iron Co. from an Army Surplus rubber bridge pontoon and a lot of imagination.

Trophy winners in Oregon Chapter's Spring Handicap Golf Tournament were, left to right: member low gross, George E. Vann, Northwest Foundry & Furniture Co.; guest low gross, Bill Barbour; member low net, Philip Ramage, Electric Steel Foundry Co.; and guest low net, Leo Wack. (Photograph courtesy of Vincent E. Belusko, Electric Steel Foundry Company).

Some of the foundrymen who attended Western Michigan Chapter's Annual Business Meeting and "Past Chairmen's Night" held at the Cottage Inn.

A familiar face at Chicago Chapter's Annual Picnic was that of A.F.S. Secretary Emeritus Bob Kennedy. (Photo courtesy of Deming H. Lucas, Chicago manufacturers' representative and membership chairman of the chapter).

tend its appreciation to Carborundum Plant Superintendent John Bergman and his staff for an interesting and informative tour.

British Columbia Chapter's James Dickson of Dickson Foundry Co., Vancouver, B. C., was present at the meeting and tour as a guest of the chapter and urged Oregon Chapter foundrymen to attend the forthcoming Regional Foundry Conference to be held at Vancouver, B. C., this fall.

Thirty members entered the Chapter's Spring Handicap Golf Tournament at Broadmoor Golf Course June 10. Member low gross and low net were won by George E. Vann, Northwest Foundry & Furniture Co., and Phil Ramage, Electric Steel Foundry Co., Portland, respectively. Like honors went to guests Bill Barbour and Leo Wack. Laurels for arranging the event go to Anthony Belusko, Electric Steel Foundry Co., tournament chairman.

Eastern New York

E. S. Lawrence
General Electric Co.
Chapter Secretary-Treasurer

A BRIGHT, SUNNY JUNE AFTERNOON was the weatherman's gift for the Eastern New York Chapter's First Annual Picnic. Location of the festivities was Endries Willow Grove Inn on the Schenectady-Ballston Spa Road. Some 55 stalwarts participated in a softball game, golf chipping contest and foot races for the sprier among them.

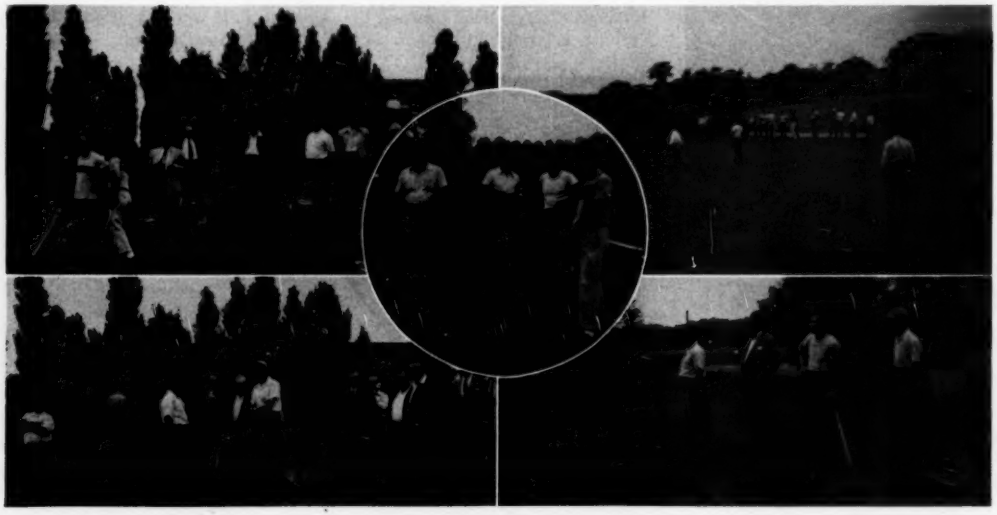
True to the tone of the occasion, a golfer who never had held a club in his hand prior to the event, chipped closest to the pin to win first prize in the chipping contest. Winner was Don LaPointe of Rensselaer Valve Co., who also won prizes in other events. Other winners included Alec Cooke, General Electric Co.; James Kiesler, General Electric Co.; William Stevenson, Rensselaer Valve Co.; and Gilbert Mirate, General Electric Co.

Ray Willey of General Electric Co. shows Newt Williams of Geo. F. Pettinos Co. how to use a dowsing rod to locate water during Eastern New York Chapter's First Annual Picnic, held at Endries Willow Grove Inn June 16.

During the afternoon, Ray Willey, General Electric Co., displayed a mysterious talent for locating water with a dowsing rod, a forked apple branch. Evening brought a luscious turkey dinner with all the trimmin's to the hungry foundry athletes, who disposed of it in good order.

Officers were then installed for the

Popular events at Northeastern Ohio Chapter's Annual Picnic, held at Lake Forest Country Club, were baseball and golf, both regular and barnyard varieties. (Photo by Sterling N. Farmer, Sand Products Corp.)



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HAND GRINDERS

for fine grinding of metallurgical specimens

The Buehler Hand Grinder No. 1410 is a most convenient piece of equipment to facilitate the hand grinding of metallurgical specimens. Two grinding surfaces are available for two grades of abrasive paper. When four stages of grinding are desired two No. 1410 grinder units are employed. A drum (7½" diameter) at the head of each grinding surface holds up to 150 feet of abrasive paper that can be quickly drawn into position and clamped firmly for use.

Either wet or dry grinding can be conveniently performed on this grinder. The surface beneath the paper is highly polished heavy black plate glass. Overall dimensions are 15" x 26" x 8"; shipping weight 70 lbs. Polishing surfaces 4" x 12".

No. 1415 grinder accommodates standard size abrasive paper sheets. It serves in a like manner as No. 1410 for the convenient hand grinding of specimens. Overall size 17"x 11"x3". Shipping weight 30 lbs.

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Combination Rammer-Compression Tester

Simple way to prepare specimens to determine compression strength.

Gordon Campbell FOUNDRY TESTING EQUIPMENT

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Each of these testing units was designed to conform with the recommendations of the Committee on Foundry Sand Research of the American Foundrymen's Society.

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coming year and Retiring Chapter Chairman Leo Scully turned the reins over to Incoming Chairman Jack Waugh, General Eelectric Co. Leigh Townley of Adirondack Foundries & Steel, Inc., is the new vice-chairman, and Ed Lawrence of General Electric takes over the chapter secretary-treasurer's duties.

Canton District
William T. Cole
Canton Malleable Iron Co.
Chapter Reporter

SCHEDULED FOR AUGUST 18 and to be reported at a later date is Canton District Chapter's Annual Picnic at Mayfield Country Club. On the roster of activities are sports, games and entertainment.

Under the chairmanship of A. S. Morgan, Babcock & Wilcox Co., the committee planning the affair consists of: Thomas Harvey, Pittsburgh Valve & Fittings Co., Barberton; Dale Crumley, Pitcairn Co., Barberton; Charles Scoville, Babcock & Wilcox Co., Alliance; Robert Epps, Stoller Chemical Co., Akron; Harold Templeton, Babcock & Wilcox Co., Alliance; Alexander Prentice, Stark Foundry Co.; and F. A. Dun, Babcock & Wilcox Co.

FUTURE CHAPTER MEETINGS

● ***SEPTEMBER 17***
QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
CLYDE A. SANDERS
American Colloid Co.
"The Effect of Mold Materials on Metal Shrinkage"

● ***SEPTEMBER 21***
CHESAPEAKE
Chambersburg, Pa.
C. D. GALLOWAY, III
Chambersburg Engineering Co.
Plant Visitation to Chambersburg Engineering Co. and Round Table Discussion

WASHINGTON
Stewart Hotel, Seattle
Film: *"Let's Get Acquainted"*
PATTERNMAKERS' NIGHT

● ***SEPTEMBER 22***
TENNESSEE
Chattanooga Golf and Country Club, Signal Mountain, Tenn.
ANNUAL PICNIC

MICHIANA
Tabor Farms, Sodus, Mich.
ANNUAL PICNIC

● ***SEPTEMBER 24***
NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
CLYDE A. SANDERS
American Colloid Co.
"Can Molding Sand Cause Metal Shrinkage?"

● ***SEPTEMBER 28***
TENNESSEE
Hotel Patten, Chattanooga
FRANK G. STEINEBACH
Penton Publishing Co.
"Foundries in the Defense Effort"

TEXAS
Hotel Menger, San Antonio
MALLEABLE IRON MEETING

ONTARIO
Royal Connaught Hotel, Hamilton
GROUP MEETINGS

● ***OCTOBER 1***
METROPOLITAN
Essex House, Newark, N. J.
WILLIAM M. BALL, JR.
R. Lavin & Sons, Inc.
"Essentials for Making Good Castings"

● ***OCTOBER 8***
CENTRAL OHIO
Hotel Chittenden, Columbus
RICHARD HEROLD
Borden Co.
"Shell Molding and Plastic Binders"

CINCINNATI DISTRICT
Suttmillers Restaurant, Dayton, Ohio
WILLIAM H. OWEN
Harbison Walker Refractories Co.
"New Applications of Ceramic Materials as Aids to Foundry Practice"

● ***OCTOBER 10***
TOLEDO
Toledo Yacht Club
Sound Film: *"Mahogany"*

● ***OCTOBER 11***
ST. LOUIS DISTRICT
York Hotel, St. Louis
RICHARD MYLES
American Brake Shoe Co.
"Safety and Hygiene"

● ***OCTOBER 12***
CENTRAL NEW YORK
Mark Twain Hotel, Elmira
LYLE L. CLARK
Buick Motor Div., GMC
"Cupola Practice"

EASTERN CANADA
Montreal
C. V. NASS
Pettibone Mulliken Co.
"Mechanization of Molding"

● ***OCTOBER 15***
QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
W. F. ROSE
Borden Co.
"New Developments in Shell Molding"

ABSTRACTS

Abstracts below have been prepared by RESEARCH INFORMATION SERVICE of The John Crerar Library from current American and foreign literature. For literature searches and translations of technical, industrial, and scientific literature, and photostats and microfilm, write to: Research Information Service, The John Crerar Library, 86 East Randolph Street, Chicago 1, Illinois. Rates for above services given on request.

Air Pollution

A141—New Techniques and Equipment. H. P. Munger, "Present Status of Air-Pollution Research," *Mechanical Engineering*, vol. 73, May 1951, pp. 405-410.

Technology is available to practically eliminate smoke and handle most fly-ash problems. Each plant's industrial problem must be analyzed individually to secure the most economical solution to the problem. Newer techniques mal e possible the determination of the concentration of air contaminants at various altitudes as well as ground levels. Meteorological observations at chimney-top level and higher are important. New equipment is being perfected to furnish specific information.

Malleable Iron Embrittlement

A142—Structural Differences Causes. H. H. Symonds, "Sherardised Castings," *Metal Industry*, vol. 78, May 18, 1951, pp. 407-408.

An investigation was carried out to determine the effect of Sherardising on malleable iron castings. The conclusions reached were that the variation of degree of embrittlement was caused by structural differences, which originated either in the grade of cast iron, or in the annealing treatment itself. The Sherardising operation could have no bearing on these differences, nor could the temperature of the Sherardising have produced the structural differences noted.

Reduce Sulphur in Steel

A143—Alloy Addition Methods. S. L. Gertsman and B. F. Richardson, "Magnesium Alloys Aid Desulphurization," *Canadian Metals*, vol. 14, May 1951, pp. 20-23.

Experiments with induction heats using two methods of introducing a 50 per cent aluminum-50 per cent magnesium alloy indicate that the sulphur content in steel can be consistently reduced by 0.010 to 0.015 per cent. The initial sulphur content does not affect these results. It was also found that the ductility of the steel was improved by this process.

Nodular Cast Iron

A144—Nodule Forming Mechanism. A. L. De Sy, "Spherulite Formation in Nodular Cast Iron," *Metal Progress*, vol. 59, June 1951, pp. 798-801.

It is the opinion of the author that there is probably only one mechanism of formation of graphite spherulites in nodular cast iron. The incorporation of minute percentages of strong deoxidizers like mag-

(Continued on Page 86)

TODAY'S ANSWER
for HIGH PRODUCTION of
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Want to *cut* costs—produce *more* per molder, and *improve* sand and casting quality? Want as high as *70 tons* of thoroughly prepared sand *per hour*? Then today's answer *for you* is the Portable Preparator!

THE PORTABLE
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Balanced for crane handling from foundry floor to floor

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NEW Foundry Products

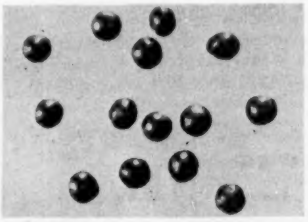
For additional information on New Products, use postcard on opposite page.

Plastic-Surfaced Plywood

1—GPX, a plastic-surfaced plywood, has, according to the manufacturer, been used in conventional 2-ft matchboards at approximately one-fifth the cost of conventional pattern lumber. This plywood eliminates the excessive thicknesses required for matchboards made with conventional wood, requires no finishing, remains dimensionally stable in the molding process and will not warp or crack. Plastic-surfaced plywood will not absorb moisture, nor will hot or damp sands cling to it. GPX is claimed by manufacturer to have 30 times the abrasion resistance of ordinary plywood, and to be acid and alkaline resistant, impermeable to moisture, snag proof, and easy to clean. *Georgia-Pacific Plywood Co.*

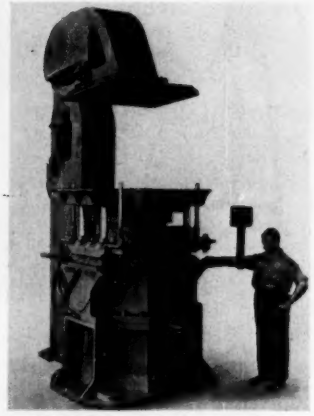
Abrasive Shot and Grit

2—Accompanying photomicrograph shows "T" Shot after it has made 50 passes through laboratory wheel testing machine. Shot and grit are approximately 200 BHN lower in hardness than conventional chilled abrasives and are ductile enough to deform before breakage occurs. Actual plant operating records show 15 to 40 per cent cleaning savings effected by these abrasives. *Hickman, Williams & Co.*



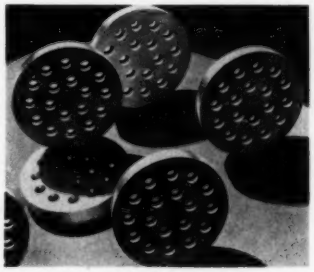
Large Molding Machine

3—Claimed to be the world's largest, Model 2364 jolt-squeeze-strip molding machine features centralized control of all operations from a conveniently located pushbutton stand to produce massive copes and drags of a uniform standard. Operating on 80 psi, machine has a squeeze capacity of 80,000 lb and a jolt capacity of 4000 lb. Squeeze cylinder diameter is 36 in., pattern draw 14 in., and squeeze piston stroke 14 in. Flask space ranges from 38 in. minimum to 54 in. maximum, left to right, and from 32 to 50 in. front to back. Squeeze head is power-operated, jolt cycle is timer-controlled, and squeeze cycle is regulated by a pressure switch. Two-speed vibrating and stripping operations are automatically controlled. Machine, designed for recessing 50 in. below floor level and extending 116 in. above, is furnished complete, ready for attachment of power lines. All servicing can be accomplished at or above floor level. *Spo, Incorporated.*



Ceramic Strainer Cores

4—The American foundry ceramic strainer core fits into mold gate and strains metal as it flows through holes of the strainer core, producing, according to manufacturer, evenly poured, slag free castings. Machine-made under high pressures, American ceramic strainer cores are fired to temperatures above 2400 F, are strong and uniform and are not affected by heat shock of molten metal. Core holes remain round and uniform during pouring operation, holding percentage of rejected castings to a minimum. Cores are available in eight sizes covering a wide range of requirements and are packed in convenient-sized cartons for easy handling. *American Clay Forming Co.*



Side-Loading Fork Truck

5—Electric-powered fork truck stacks to either side while parked lengthwise in aisles only six feet wide, cutting down appreciably on space required for materials handling in foundries. Instead of the truck making a 90 degree turn to stack, the forks do it while the truck remains stationary. Rotary action turns forks either to right or left, and a scissors-like expanding motion pushes the forks out as much as 54 in. Lifting procedure follows standard method. Mounted on 5,000-lb capacity Automatic Skylift Truck, unit can handle pallet loads up to 2500 lb and measuring as large as 48 x 48 in. Truck operates hydraulically and operations are governed by pushbuttons. System of electrical interlocks protects accidental extension of load forward before forks are turned to the side. Load thus cannot exceed the truck's inch-pound capacity. *Automatic Transportation Co.*

Surge Damping Valve

6—Designed to prevent shock in high-pressure hydraulic systems, new surge damping valve is a unit adaptable to any hydraulic circuit. Valve is small and compact and is claimed by manufacturer to prevent shock from occurring, rather than simply absorbing hydraulic surge and consequent shock. Possible applications include installation at ports of 4-way valves; in a cylinder circuit as an automatic decompression valve; and in any line leading from an accumulator. Valve will open at a slower rate of speed at high pressures than at low pressures, when the valve is subjected to sudden surges of fluid. *Denison Engineering Co.*

Crane Cab Cooler

7—Split-Type Crane Cab Cooler, a new unit for air conditioning of cabs of cranes operating in high temperatures or in atmospheres contaminated by toxic and noxious gases or dusts, requires no ductwork for installation because cooling section is installed in the cab itself and the larger condenser section is placed outside on the crane in any convenient location. Unit provides constant year-round ventilation, filters air to remove dust, cools the air in the summer and, if necessary, heats it during the winter. Thermostatically-controlled, unit will maintain a temperature of 80 to 85 F when the outside ambient temperature is 175 F. During the heating cycle, unit keeps temperature in the cab at 68 to 75 F with an ambient temperature of zero outside. Unit can be installed quickly and easily on any type of crane or in control pulpits, with minimum of down time. *Drake Corp.*

Tumbling Compound

8—An improved wet process tumbling compound for ferrous metals, Tumb-L-Magic, is the newest addition to the Tumb-L-Matic line of equipment, compounds and techniques for metal finishing. Cleaner acts to suspend grease and cuttings in the solution, keeping work surfaces and abrasive media free of action-retarding accumulations, and, according to manufacturer, use of Tumb-L-Magic in conventional tumbling equipment will result in faster, higher finish than is obtainable with similar compounds. *Tumb-L-Matic, Inc.*

Corrosion-Resistant Paint Base

9—Anchorite 100, a new phosphate compound for treating metallic parts, gives uniform results and meets U. S. Army Specifications 57-0-2C and Armed Services Specification JAN-C-490 for changing the surface of steel, iron, zinc and cadmium parts into inert phosphate compounds that provide a base for organic coatings. Anchorite 100 surface is non-conductive, eliminating electrochemical breakdown and providing an insulating barrier between metal and paint. Application is simple and inexpensive, requiring no elaborate equipment, and can be accomplished either by immersion or spray for both small and large production needs. *Octagon Process, Inc.*

Overhead Conveyor System

10—Mono-Dyne, a battery-powered overhead conveyor system, can be installed without complicated overhead wiring and can easily be incorporated into present manually operated systems, making them power-operated at a minimum of expense. Unit is capable of multi-speeds, forward and reverse, and is operated by pushbutton or remote control if desired. Because driving power is self contained, Mono-Dyne conveyors are not subject to limitations of standard conveyors and can operate outdoors, from plant to plant, and are capable of ascending grades. *The Bloom System, Inc.*

Noiseless Vibrator

11—Type AC (Air-Cushioned) air vibrator is designed for applications where air vibration is used close to employees and where noise is a major factor. Basically, reciprocating action of a chrome plated piston develops the vibrating action, which is noiseless because momentum set up by the piston is cushioned by a pocket of air at each end of the vibrator assembly. Speed and intensity of vibration can be varied at will. Unit weighs 2 lb, 11 oz and is 6¼ in. long by 1¼ in. wide. *Cleveland Vibrator Co.*

Conveyor Tractor

12—Caleber Fluid Tractor features magnetically-operated clutch which engages drive wheel when power is on and disengages, allowing tractor to roll freely, when power is off. Tractor-propelled load can be quickly hand-spotted without jogging and on existing conveyor lines tractor with sub-assembly can freely follow movement of main conveyor line. Tractor is available with either ⅓ or ½ hp, 3-phase electric motor operating at 1750 rpm, fits any track with flat or tapered end from 2 in. minimum to 6-¼ in. maximum. Tractor moves loads up to 5 tons. *Caleber Corp.*

Portable Metal Slitting Machine

13—Portable metal slitting machine comes in two models and is designed for small shops with no room for a large shear and for large shops with too much work for their heavy shears. Machines handle up to 16 or 20 gage mild steel and can rip two or more sheets of light-gage aluminum, for example, at a time. Throat depth of 27-in. permits cut to center of 4 ft sheet of any length. High-grade steel blades hold up indefinitely without sharpening. *Wilder Mfg. Co.*

(Continued on Page 99)

Reader Service (SEPTEMBER/51)

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FOUNDRY Literature

For additional information on Foundry Literature use postcard at bottom of this page.

Super Refractories

16—Technical information of a basic nature on super refractories is the subject of a 20-page booklet, illustrated with photographs, diagrams and charts. Explained in the text are applications and properties of super refractories, temperatures at which they can operate, use of heat-containing or heat-conducting refractories, chemical inertness of refractories, purity, strength, resistance to abrasion, overcoming thermal shock and spalling, and various types of super refractory special shapes. *Carborundum Co.*

Vibrating Screens

15—20-page illustrated booklet 2377 contains specific information on selecting screen and screen cloth for vibrating screens, dimension tables, weights, hp requirements, and other data concerning vibrating screens for dry-screening of light and fine materials, and liquid vibrating screens for separation of solids from liquids. *Link-Belt Co.*

Industrial Ventilation

18—Described in Vol. 15, No. 1 of *Weather Magic*, Trane Co. house organ, is complete line of Trane industrial ventilation equipment, its applications in a variety of industries, and typical installation photographs. *Trane Co.*

Welding and Cutting Safety

17—Pocket-size 24-page booklet outlines safety procedures and rules governing operation and handling of oxyacetylene and arc equipment for welding and cutting. Outlined in the text are personal safety, handling and care of cylinders and of torches and regulators, setting up equipment, adjusting pressures, backfires and flashbacks, fire prevention, working on tanks and containers, shutting down, dangers and cautions in electric welding. *Air Reduction Sales Co.*

Battery Maintenance Plan

18—Plus-Performance Plan, designed to help industrial battery users get maximum power and life from batteries for extra defense production during lead cutbacks, consists of a complete, integrated system of manuals, articles, specifications, bulletins, records and charts that explains how to choose, install, charge, maintain, inspect and test batteries. Booklet is available explaining the Plan, which is offered gratis and without obligation. *Gould-National Batteries, Inc.*

Rough Grinding

19—Pocket-size, 56-page booklet describes Norton wheels for rough grinding in foundries, welding, forge and machine shops. Containing specifications, recommendations and tips on grinding, booklet covers abrasives and bonds, wheel selection, floorstand and portable grinding, welds, swing frame grinding, grinding costs, and many types of grinding wheels and accessories. *Norton Co.*

Concrete Structural Design

20—12-page booklet contains illustrated article on structural design of refractory and heat-resistant concrete. Tables, charts and installation photographs supplement data on design strength, volume changes, reinforcing refractory concrete, suspension reinforcing, conventional reinforcing, combining two methods of reinforcing, side wall reinforcing, sprung arches and domes, unreinforced walls and roofs, repairs, wall thickness, etc. Lumnite Div., *Universal Atlas Cement Co.*

(Continued on Page 84)

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AMERICAN FOUNDRYMAN

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Reader Service (SEPTEMBER/51)

AMERICAN FOUNDRYMAN

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MALLEABRASIVE®*

(SHOT AND GRIT)

SAVES $2995.00 a year CLEANING CASTINGS Like These!

BEFORE

AFTER

Here's the report from Lynchburg Foundry

Lynchburg took advantage of Pangborn's offer to test Malleabrasive in their own shop. They tested it against ordinary shot for three months, and *their own records* prove Malleabrasive saves them $2995.00 a year on blast cleaning. Not only that, but replacement parts cost has been reduced *73.8%*—and abrasive handling has been cut in half!

Malleabrasive is the *original* long-life abrasive pioneered by The Globe Steel Abrasive Co., Mansfield, Ohio. Pangborn invites you to test Malleabrasive as Lynchburg Foundry did. Use it in your own cleaning room and find out exactly how much you can save!

SEND FOR FREE TEST KIT

Contains all the forms you need to run an impartial test. Remember, Malleabrasive is guaranteed to outperform ordinary shot and grit when comparative tests are properly run. For your free kit, write today to: PANGBORN CORPORATION, 1300 Pangborn Blvd., Hagerstown, Md.

These savings are possible because MALLEABRASIVE

- *is designed for modern cleaning equipment*
- *wears out fewer machine parts*
- *lasts 2 to 4 times longer*
- *reduces machine down-time*
- *reduces cleaning costs up to 50%*
- *increases output of cleaned castings*

PLACE A TEST ORDER TODAY

Packed in orange striped 100-pound bags with this tag.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

*U. S. Patent #2184926 (other patents pending)

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

LITERATURE

(Continued from Page 82)

Brinell Hardness Table

21—Pocket-size table of Brinell hardness numbers on one side sets forth numbers for a 3000 kg load in the 682 to 93.7 bhn. Also given is approximate Rockwell C scale in the 62-C to 21-C. Reverse side contains three tables reprinted from ASTM Tentative Standard E-10: (1) recommended Brinell load for various hardness ranges, (2) minimum thickness of test specimen used in Brinell method, and (3) recommendation for determining type of ball penetrator to be used with various hardness ranges. *Steel City Testing Machines Co.*

Foundry Refractories

22—Four-page folder describes and pictures machine-made cupola blocks of Kentucky flint and semi-flint clay, plus other foundry refractories. Listed in addition to 4½, 6 and 9 in. series cupola blocks is a special block made to form any radius in a cupola. Fourteen cupola specialties are illustrated, including tap-out blocks, cupola spout brick, and slag hole blocks in standard sizes or made to order. *Ironton Fire Brick Co.*

Cupola Operations

23—New illustrated folder, "How to Make Your Cupola Operation More Efficient," answers many cupola problems, particularly those affected by today's shortages in materials and manpower. Included are practical suggestions on overcoming raw materials shortage troubles, lighting the bed, blast control, refractories, tuyeres, charging, carbon control, hot blast, moisture control and duplexing. *Whiting Corp.*

Metallurgical Polishing Materials

24—20-page booklet on materials used in metallurgical polishing describes and includes samples of emery, aluminum oxide and silicon carbide papers, plus 12 polishing cloths. Listed are trade names and particle sizes for many types of abrasives. *Buehler, Ltd.*

Tramp Iron Removal

25—16-page catalog on non-electric permanent magnetic separators for tramp iron removal contains complete descriptions of separators and such engineering data as photographs, line drawings and tabular specifications. Also included is information on selection of magnetic separators, the factory engineering service available, etc. *Eriez Mfg. Co.*

Engineering Irons

26—28-page basic reference bulletin, compiled primarily for engineers, outlines characteristics of modern nickel cast irons and their applications in industry. Illustrations, tables, charts and photomicrographs show how nickel, alone or in combination with alloying elements can control engineering properties of cast iron to meet almost any reasonable combination of service requirements. *International Nickel Company.*

Industrial Truck Maintenance

27—16-page manual tells how to care for and maintain industrial trucks. Containing 51 illustrations, manual outlines step-by-step the procedure for annual check-ups and for preventive maintenance. *Baker Raulang Co.*

Ramming Mixes and Patches

28—16-page illustrated booklet 315 discusses properties and applications of Taylor Sillimanite Super-Refractory Ramming Mixes and Patches. Given are descriptions of several types of ramming mixes, pre-formed and fired secondary or slot blocks, facts about hot roofs of direct arc furnaces, suggested ramming procedures, tips on patching. *Chas. Taylor Sons Company.*

Jolt Strippers and Squeezers

29—Bulletin No. 8, 4 pages, describes improved heavy-duty Nichols Type 8JS Jolt Stripper and Type 14PL Jolt Squeezer Molding Machines. Outlined are such advantages as increased output, sensitive operation, simple controls, permanent alignment, maximum wearability and freedom from maintenance needs. Specifications and dimensions are given in detail for each type of molding machine. *Wm. H. Nicholls Co., Inc.*

Sand Preparation Unit

30—4-page illustrated folder contains diagrammatic plan and elevation views and double-spread photograph of the Reddy Sandy, a portable shakeout and sand preparation unit that eliminates all shoveling from shakeout, sand preparation and molding cycles in the foundry. Also given are operating characteristics and advantages of the unit. *Newaygo Engineering Co.*

Induction Heating and Melting

31—Selector chart for induction heating and melting, and a table giving heating and melting speeds for standard induction equipment are featured in an 8-page booklet which gives case history descriptions of melting and heating installations and various types of equipment. *Ajax Electrothermic Corporation.*

Revised Hydraulic Standards

32—16-page booklet on hydraulic standards incorporates all changes and additions made at the most recent meeting of the Joint Industry Conference on Hydraulics and is offered gratis to engineers, designers and hydraulic equipment users and manufacturers. Booklet also includes a sample circuit, glossary of terms, two pages of standard symbols, information on types of piston and rod seals, and cutaway illustration of Miller hydraulic cylinders. *Miller Motor Co.*

Compressed Air Cleaner

33—Bulletin 1150 describes specifications, applications and operation of the Aridifier, a device which removes 92 per cent of oil, moisture and dirt from compressed air or gas lines. Charts show Aridifier capacities in cfm (free air), dimensions and prices. Selection of sizes and installation data are also given. *Logan Engineering Co.*

Specimen Polishing Compound

34—Folder tells advantages of diamond abrasives for polishing metallurgical specimens. Diamet-Hyprez, described in folder, is available in three particle sizes, all in 5 gram and 18 gram gun applicators. *Buehler, Ltd.*

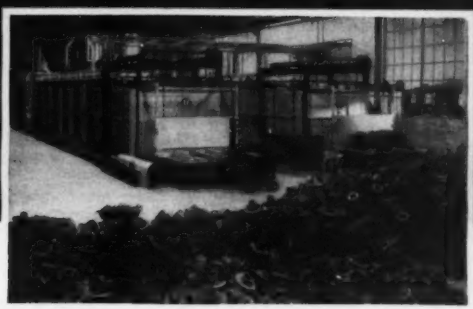
Production Research

35—8-page illustrated booklet describes current research in production engineering being undertaken at Battelle Memorial Institute, Columbus, Ohio. Outlined are the Institute's services to industry, what research covers, how manufacturers can profit from production research, and objectives of Battelle research. *Battelle Memorial Institute.*

Conveyors

36—12-page illustrated bulletin describes complete line of Lake Shore flight and belt type portable conveyors and under car unloaders for handling coal, coke, sand, gravel and other bulk materials. Brief specification data is given on both electric and gasoline-powered models and on hand-move and self-propelled conveyors. *Lake Shore Engineering Co.*

EF MALLEABLE FURNACES



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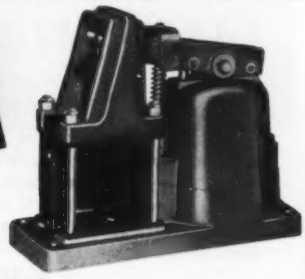

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"T" Shot and Grit are rapidly becoming preferred abrasives in leading defense plants because "T" Shot and Grit deliver:—faster, finer cleaning of castings, forgings, and heat treated parts — up to 88% longer abrasive life — up to 83% longer blade life—30% to 50% reduction in total abrasive and maintenance costs.

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Established 1890

ABSTRACTS

(Continued from Page 79)

nesium, cerium, lithium, barium, calcium, and strontium give the result. The solidification of as-cast nodular magnesium-treated iron corresponds to undercooling without any recalescence However, the results obtained do not lead to any definite conclusions as to the mechanism involved.

Cupola Slag Practice

A145—Fixed Proportions of Fe and Mn. E. Witten, "Slag Formation in the Cupola Furnace," *Giesserei*, vol. 10, May 17, 1951, pp. 221-227.

A discussion is given of the problem of slag formation and its relation to the operation of the cupola furnace. It has been established that certain fixed proportions of iron and manganese are taken up in the course of slag formation. These proportions depend on the melting point of the CaO_2-SiO_2-Al_2O_3-earth mixture of the slag, on the lime-silicic acid ratio, and on the temperature. The desulphurization is also found to depend upon the basicity and melting point of the slag. The effect of fluorspar in the cupola is discussed.

Radiographic Testing

A146—Compare Radioactive Sources. C. G. Carlstrom, "Gamma-rays for Non-Destructive Testing," *Gjuteriet*, vol. 41, May 1951, pp. 67-71.

A brief outline is presented on the historical development of X-ray and gamma ray non-destructive testing. The advantages of artificially produced radioactive materials in gamma radiography are especially pointed out. A brief discussion is also given of the health hazards involved, and of necessary precautions.

Die Casting Practice

A147—Temperatures, Gating, Pressure. E. N. Field, "Sound Die Castings," *Metal Industry*, vol. 78, April 27, 1951, pp. 323-326.

A discussion is given of the conditions which must be complied with in order to produce sound die castings. Among these are the use of low injection temperature, maintenance of a high average die temperature, correct positioning of the gate, disposition of the runners, and provision of a sufficiently high injection pressure.

Casting Defect Causes

A148—Chemical and Physical Factors. Albert Portevin, "Definition and Classification of Founding Defects of Metallurgical Origin," *Fonderie*, vol. 62, February 1951, pp. 2345-2358.

Founding faults, classified as due to the action of chemical or physical phenomena, are described and illustrated. The chemical phenomena considered include segregation—inhomogeneity of chemical composition—and release of gases. The physical actions include the formation of pores and cavities, deformation and shrinking, and the action of internal stresses.

Among the various factors leading to the reactions are: (1) metal used; (2) conditions under which the casting is made; (3) mold; (4) work piece; (5) contact between mold and work piece.

PERSONALITIES

(Continued from Page 66)

S. J. Moran was recently elected president of Blaw-Knox Co.'s Union Steel Castings Division, Pittsburgh. Mr. Moran has been with the division since 1920 and has been, successively, purchasing agent, office manager, production manager, and works manager, and since last year general superintendent of the division.

P. M. Budge has been named foundry superintendent of the Shoe Hardware Division of United States Rubber Co., Waterbury, Conn. Mr. Budge was formerly with the Aluminum Corp. of America.

Russell F. Ekrut, formerly associated with Whirlpool Corp. as assistant to the director of service, has been named general service manager for the Kalamazoo Stove & Furnace Co., Kalamazoo, Mich.

Ralph Rathyen has been named assistant manager of the Crucible and Refractories division of the Joseph Dixon Crucible Co., Jersey City, N. J. Mr. Rathyen, who first joined the company in 1939, served as Lieutenant of Engineers in World War II.

Daniel J. Manning, Jr., formerly assistant purchasing agent for Swan-Finch Oil Corp., New York, has been appointed sales promotion manager.

J. H. Redhead, president of Lake City Malleable Iron Co., Cleveland, was recently elected a trustee of Baldwin-Wallace College, Berea, Ohio.

L. M. Evans will head Worthington Pump & Machinery Corp.'s new branch office at 1246 Sibley Tower Bldg., Rochester, N. Y. He has been with the company since 1936 in its Buffalo, Syracuse and St. Louis district offices.

Patrick Dolan, sales engineer for Patterson Foundry & Machine Co., East Liverpool, Ohio, will manage the company's new office at 1605 Court Square Bldg., Baltimore.

Joseph J. Schmelzer, secretary of Arkansas Foundry Co., Little Rock, is chairman of the Arkansas Steel Scrap Mobilization Committee.

Charles Fruchtman, president of Maumee Malleable Castings Co., Toledo, recently donated a hall named in his honor to Brandeis University, Waltham, Mass.

George A. Lieser has been named special sales engineer, and **Earl E. Broadhag** development engineer for Liquamatte equipment manufactured by American Wheelabrator & Equipment Corp., Mishawaka, Ind. For the last six years, Mr. Lieser has been a manufacturers' agent for liquid blasting equipment and previously held sales engineering positions with Gould Pump Co., Fairbanks-Morse, and the Van Der Horst Corp. of America. Mr. Broadhag was formerly with Vapor Blast Mfg. Co. and Buick Motor Division, General Motors Corp.

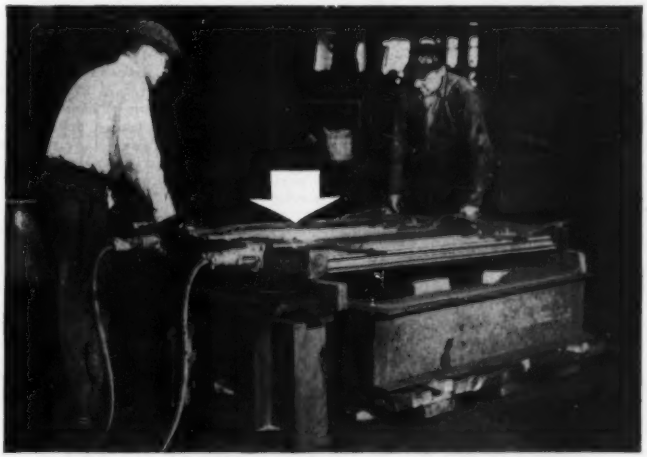
George Breza, assistant chief engineer for Mackintosh-Hemphill Co., Pittsburgh, since 1937, has been named chief engineer. A graduate of Carnegie Institute of Technology, Mr. Breza is a registered professional mechanical engineer in Pennsylvania and was formerly engaged in designing furnaces and machinery for Amsler-Morton Co.

Walter R. Hewell, formerly assistant controller for Eversharp, Inc., has joined Acme Aluminum Alloys, Dayton, Ohio. Mr. Hewell is a member of the New York State Society of Certified Public Accountants, American Institute of Accountants, Controllers' Institute, and the National Association of Cost Accountants.

Avery C. Newton, formerly on the staff of the American Newspaper Publishers Association, New York, has been named executive secretary of the Refractories Institute, Pittsburgh, a non-profit association recently incorporated for the advancement of industrial trade and consumer relations among manufacturers of refractory products.

Pierre O. Wood, sales engineer for General Steel Castings Corp., Granite City, Ill., has been appointed assistant manager of service. Mr. Wood, who has been with General Steel since 1929, became a sales engineer in 1945.

(Continued on Page 91)



Portable bank of six lightweight Chromalox 2½-KW electric radiant heaters is easily moved from mold to mold; provides uniform, wide-band infrared heat with an even degree of penetration that eliminates moisture pockets, yet does not burn high spots. Handles on each end of bank make handling easy.

Foundry Gets Extra Mold Daily for 2000-Lb. Casting

Milwaukee, Wisconsin—A local foundry has added an extra unit to its daily production of large sand molds, without adding manpower, by changing to Chromalox Electric Radiant Heat for skin drying. As molds are used for 2000 to 3000-pound castings, production boost represents a substantial increase. Other advantages achieved with new drying method are: uniform drying of mold surfaces; quick warm-up; heat confined to work; and no toxic gases.

Drying was previously handled manually with an open kerosene torch, a hot, disagreeable task requiring full-time services of one man, and subject to human error. Occasional burning of some mold spots and incomplete drying of others often caused scrapping.

Two new drying units each consist of six 2½-kw, all-metal, Chromalox Electric Radiant Heaters with handles on each end of heater bank for easy portability. Heaters radiate long wave length, unfiltered infrared heat that is absorbed uniformly. Heaters can be switched on and off in groups of three. Rugged and compact, heater banks have now been in use for many months without damage.

Success of this Chromalox Electric Radiant Heater installation has, according to the plant's assistant superintendent, led this company to plan on four more similar setups.

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FOUNDRY FIRM *Facts*

Coleman-Wallwork Co., Ltd., is the name of the newly combined firms of **Stone-Wallwork Co., Ltd.**, and **Coleman Foundry Equipment Co., Ltd.** Headed by J. Stone, the new company's offices, workshops, technical and research departments will be located at Windsor Works, Stotfold, Bedfordshire, England. Additional offices are at 157 Victoria St., London S.W. 1, and 12 Bulldale St., Glasgow 4, Scotland.

Linde Air Products Co., A Division of Union Carbide & Carbon Corp., announces completion of plans for a liquid oxygen and argon plant to be constructed at Ashtabula, Ohio. The plant's products will be used principally by area steel and metalworking plants. The new plant will be built on the property of the **Electro Matallurgical Co.**, Division of Union Carbide & Carbon Corp., on East Lake Road, Ashtabula. The Electromet plant has its own power-producing facilities. Completion of the plant is scheduled for late spring or early summer of 1952.

Lowenthal Metals Corp. is celebrating its 40th year of continuous occupation of premises at 947 West Cullerton St., Chicago, with a continuous open house.

United States Radiator Corp. has acquired manufacturing facilities of the **Highway Steel Products Co.**, Chicago Heights, Ill. This plant will be U. S. Radiator's ninth and will be a Metal Products Division. Its facilities are set up to process steel and aluminum and include welding equipment, heavy presses for stamping and forming, and a modern finishing department for bonderizing and enameling.

Pittsburgh Coke & Chemical Co. announces completion of the first major unit of its new Central Research Laboratories at Neville Island, near Pittsburgh. The new unit more than doubles the company's available laboratory space and is designed to take care of additional research requirements stemming from the company's expanding production of chemicals. Laboratories are constructed principally from the company's products—precast concrete curtain walls, floors and roofs, lightweight concrete block for interior wall partitions, bituminous coatings used to seal exterior walls, and synthetic coatings applied to all exposed metal surfaces.

British-American Carbon Corp. has been formed jointly by **Great Lakes Carbon Corp.** and England's **Powell Duffryn Carbon Products, Ltd.**, to manufacture and sell a wide range of carbon and graphite products for the metal and chemical industries in the United States. William J. Crawford of Great Lakes Carbon Corp. has been elected president of the new company, whose offices will be located at 18 East 48th St., New York City.

Thompson Products, Inc., on August 10 purchased the steel fabricating plant at Danville, Pa., formerly owned by National Radiator Co. Originally used by Rheem Mfg. Co. for the manufacture of war materials in World War II, the plant was taken over and renovated by National Radiator after the war. Thompson Products, the new owner, will devote 140,000 sq ft of floor space to manufacture of component parts for the aviation industry.

Harold J. Roast, bronze foundry consultant, has moved his offices from 324 Victoria St., London, Ont., Canada, to c/o Crown Trust Co., 284 Dundas St.

Castalloy Co., Inc., Everett, Mass., has reactivated its magnesium and heat-treated aluminum foundry facilities and is back in production on ordnance and aircraft castings. Heading the company's operations are President Fred Hengesch, Vice-President and Treasurer Francis McConville, and Superintendent George Flanders.

Alumicast Corp., Chicago, was recently host to a British zinc and aluminum die casting productivity team. Looking over permanent and semi-permanent mold casting facilities are, from left: Alumicast Research Director Walter Bonsack, Visitor Charles R. Lyons of Imperial Smelting Corp., Ltd., London; Alumicast Vice-President and General Manager John G. Mezoff and one of the Chicago plant's employees.

Ford Motor Co. has authorized a $43 million expansion and modernization of

Illinois Engineering Students Study Matchplate Production

A regular semester feature of foundry classes from the University of Illinois (Navy Pier) is a visit to Scientific Cast Products Corp., Chicago, to learn first hand about pressure casting of matchplates. In the center, discussing a plaster mold for a class are, starting left, Prof. R. W. Schroeder, Prof. R. E. Kennedy, and Otto Hare, Scientific Cast Products. The students witness operations from the master pattern through the production of small drags and copes and assembly into larger units, to pressure casting.

steel operations at its Rouge Plant. Now underway and expected to be completed by March, 1953, the program will increase total Ford steel output about 18 per cent. Scheduled for construction are 37 coke ovens, a sinter plant, new pig casting equipment and improvements in open hearth and rolling mill facilities. A portion of the increased coke capacity will be used to supply the new Ford foundry in Cleveland. Because foundry capacities were so critical in World War II, Ford is today backing up foundry capacity with added coke facilities.

Gerity—Michigan Corp., Adrian, Mich., has been awarded a contract by the Air Force to produce rough magnesium castings for supplying various aircraft engine manufacturers. The building will be provided by the Corporation and equipment is to be supplied by the Air Force. Construction of the plant, which will eventually employ 250 men, will begin immediately. Leslie Brown, formerly plant manager, Bohn Magnesium & Brass Co. Foundry, will be in charge of the operation.

Kennard & Drake, Los Angeles consulting engineers, chemists and metallurgists, have moved their testing laboratories to their new building at 3364 East 14th St., Los Angeles 23.

Chas. Taylor Sons Co., Cincinnati, has been acquired by National Lead Co., and will be operated under its present management as a wholly owned subsidiary, with main offices and a plant in Cincinnati and another plant at Taylor, Ky. Founded in 1864 to manufacture fireclay brick, the company entered the foundry field in 1926 with the manufacture of bonded super refractories, and in 1933 added zircon refractories to its line. Manufacture of fireclay products was discontinued in 1944. Since then the company has devoted its entire output to production of high-temperature refractories.

Allied Steel Castings Co., Chicago, has elected J. T. Llewellyn, II, president; L. J. Wise, vice-president; and L. F. Hartwig, assistant to the president.

Dow Corning Corp. has moved its main offices to 600 Fifth Ave., New York 20.

Productioneering Co., Inc., 219 Page Blvd., Springfield, Mass., has been named representative for the Hyster Co., industrial truck and crane manufacturers of Portland, Ore., in parts of Massachusetts, New York and New Hampshire, and all of the state of Vermont.

Stockham Valves & Fittings, Inc., during its recent two-week vacation shutdown installed two new cupolas in its gray iron foundry. The cupolas are 70 ft high and 8 ft in diameter, and will soon have automatic air-operated controls for opening and closing tuyeres.

Inesco, Inc., recently formed corporation for sale of engineered foundry equipment, announces appointment of Otto H. Rosentreter as general manager. The new com-

2-WAY PROTECTION FOR MAGNESIUM FIRES

PREVENT FIRES IN POURING AND HEAT-TREATING OF MAGNESIUM . .

. . . INSTALL AN ANSUL POSITIVE CONTROL SO_2 SYSTEM

The danger of fire is a constant threat in pouring and heat treating of magnesium. . . . you can reduce this ever present danger by installing:

1. An Ansul SO_2 System for mold flushing immediately before pouring, and
2. An Ansul manually controlled SO_2 system to maintain positive control of a protective atmosphere in your heat treating ovens.

The use of Ansul SO_2 Systems reduces the fire hazard by preventing oxidation, reaction and ignition of magnesium and its alloys during pouring and heat treating operations.

Ask for your copy of bulletin No. A 940. In addition you can also obtain the services of one of Ansul's Chemical Engineers without cost or obligation. He will gladly cooperate with you in developing systems for your foundry.

EXTINGUISH FIRES IN THE CLEANING & MACHINING OF MAGNESIUM CASTINGS

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ANSUL MET-L-X DRY POWDER FIRE EXTINGUISHERS

MODEL MX 30-A

Ansul Met-L-X Dry Powder Extinguishers are designed to allow safe application of a special extinguishing compound for burning metal fires.

Ansul Met-L-X Dry Powder is particularly effective when applied to magnesium turnings, chips and castings.

Get the facts. Write for File No. 695. You will receive complete information and other valuable data.

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pany, located at 3050 East Slauson Ave., Huntington Park, Calif., will represent the following firms in California, Arizona, Nevada and Utah: National Engineering Co., Osborn Mfg. Co., Foundry Equipment Co., Young Brothers Co., Hines Flask Co., Harry W. Dietert Co., Whiting Corp.

Applied Research Laboratories, manufacturers of spectrochemical equipment, has completed a new plant for the manufacture of quantometers and source units for production control, located at 3630 San Fernando Rd., Glendale, Calif. Also under construction is a new building for the company's general offices and development division at Montrose, Calif.

National Malleable & Steel Castings Co. will undertake a $6,300,000 defense effort production expansion. Largest expenditures will be made at the company's Cleveland Works, but the company's Chicago, Indianapolis, Sharon, Pa., and Melrose Park, Ill., plants will also undergo expansion under the program.

Wellman Bronze & Aluminum Co., Cleveland, will undergo a $500,000 expansion of its facilities for casting magnesium aircraft parts, and has leased a building at Cleveland and Henry Sts., Cleveland, which will be equipped for production of light magnesium castings.

Pekay Machine & Engineering Co., Chicago manufacturers of foundry sand handling and conditioning equipment, announces the opening of a sales, service and engineering office at 13720 Puritan Ave., Detroit 27.

Lester B. Knight & Associates, Inc., Chicago, are engineers and architects for a 70-ton-a-day gray iron and brass foundry to be constructed by Fairbanks, Morse & Co. at Kansas City, Kansas.

Solar Aircraft Co. has made 11 of its patents available for free use by the public. Of interest to foundrymen is that for a centrifugal casting machine for forming exhaust parts for plane engines.

Battelle Memorial Institute, Columbus, Ohio, world's largest independent industrial research foundation, will establish a European branch of its laboratories to serve the European economy. According to Battelle Director Clyde Williams, "The accumulated knowledge and experience gained through Battelle's service to American industry can do much to help industry in Europe increase its productivity and elevate standards of living there. At the same time, European science has much to offer American scientists, especially in the way of fundamental knowledge and research. By working together, research men of both continents will benefit from each other." Exact location of the European branch and other details will depend upon the outcome of negotiations now in progress. It is anticipated that the service will be in operation early in 1952.

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1. The finest quality Matchplates ever produced in our history!
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PERSONALITIES

(Continued from Page 87)

Victor M. Rowell has resigned his position with Kordell Industries to become technical representative for Archer-Daniels-Midland Co.'s Foundry Products Division, Cleveland. Mr. Rowell, who is chairman of the A.F.S. Committee on Physical

V. M. Rowell

Properties of Iron Foundry Molding Materials at Elevated Temperatures and a charter member of the Cope and Drag Club, was for nine years in Buick Motor Division's foundry, and in Velsicol Corp.'s Core Oil Department for three years. Also

M. E. Roe

newly appointed by A-D-M is **Mayo E. Roe**, to be representative for its Foundry Products Division in Michigan. Mr. Roe is a graduate of Cornell University and served Air Force Ordnance in World War II.

Frank E. Fisher, sales manager for the Hydro-Blast Corp., Chicago, is the newly appointed assistant chief of the Foundry Equipment & Supplies Section, General Industrial Equipment Division, National Production Authority, Washington, D. C. Mr. Fisher's career has included executive metallurgical engineering positions with Green Foundry Co., St. Louis; Western Foundry Co., Chicago, and Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., prior to joining Hydro-Blast.

(Continued on Following Page)

For Better Castings

EASY TO USE LADLE ADDITIONS THAT RESULT IN CLEANER METAL, IMPROVED MACHINABILITY, INCREASED PRODUCTION AND LOWER COSTS

"SIL-X" EXOTHERMIC FERROSILICON

Only way possible to add quantities of silicon and heat to the molten metal at the same time. Two grades of "Sil-X" . . . "145" . . . "217." **"SIL-X"** additions are easily made. The required amount is added as soon as a cushion of metal covers the bottom of the ladle — the stream of metal entering the ladle assures its distribution.

"RISER-X" EXOTHERMIC METAL COVERING

WRITE FOR DESCRIPTIVE FOLDERS ON THE USE OF "CHROM-X" "SIL-X" "CARB-X" and "RISER-X."

Reduces shrinkage in castings and reduces piping in ingots. Easy method of application makes its regular use economical. An inch or two of "Riser-X" is added to the mold when the metal enters the base of the riser, the point where shrinkage usually occurs. A temperature of 4000° is developed by the "Riser-X," thus keeping the metal fluid. No carbon pick up when "Riser-X" is added.

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National Bentonite helps so greatly in making minimum moisture content molds, with high green strength and high hot strength too, that it's small wonder so many good foundrymen use National Bentonite to minimize the hazard of gas holes and blows, and to produce finer-finish castings as well.

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Chicago, Illinois

Stoller Chemical Co.
227 W. Exchange Ave.
Akron, Ohio

Wehenn Abrasive Co.
Chicago, Illinois

Mr. Walter A. Zeis
Webster Groves, Missouri

Lawrence E. Emery has resigned as metallurgist, Benton Harbor Malleable Industries, Benton Harbor, Mich., to become metallurgist for Marion Malleable Iron Works, Marion, Ind., where he will be in charge of all metallurgical operations.

L. E. Emery

Oswald H. Hecht has been named plant metallurgist for the Ajax Metal Division of H. Kramer & Co., Philadelphia. A graduate of the University of Vienna, Dr. Hecht has been associated with several smelting and refining firms in Austria, and in 1938 established the China Centrifugal Casting Co., but in 1949 had to abandon the project when the Chinese Communists took over the country.

OBITUARIES

Peter Mate, 68, died of a heart attack July 22 in Chicago. Retired for the past seven years, he was foundry superintendent of Greenlee Foundry Co., Chicago, from 1926 to 1944, and before that was general foundry foreman with Whiting Corp., Harvey, Ill. He was a 50-year veteran of the foundry industry.

Edward Toye, 48, president of the Joseph Toye Co., Bridgeton, N. J., brass and iron foundry, died at his home in Centerton, N. J., June 16. Mr. Toye, a graduate of Temple University and the Wharton School of Business Administration, both of Philadelphia, was a member of A.F.S., ASM and the New Jersey Manufacturers' Association.

William C. Johnson, 49, executive vice-president of Allis-Chalmers Mfg. Co., Milwaukee, died July 26. Mr. Johnson was also a member of Allis-Chalmers' Board of Directors and Executive Committee and chairman of the Board of Canadian Allis-Chalmers (1951) Ltd. Mr. Johnson began at Allis-Chalmers in 1924 as a machinist's helper, was for a time in the service and sales departments, becoming crushing and cement sales manager in 1940, machinery products sales manager in 1942, vice-president of the General Machinery Division in 1944 and was named executive vice-president in 1948. Mr. Johnson was past president of the National Electrical Manufacturers Association and at the time of his death was a director of the National Association of Manufacturers.

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FOR HEAVY PATTERNS

The "Oliver" No. 18 Double-End Wood Lathe handles heavy as well as general work economically. Made in three capacities to swing 32", 36", 42" over bed; 28", 31", 38" over carriage. At outer end of head spindle it swings 88", 92", 98". Turns 8'1" between centers—bed can be made in any desired length. Has automatic feeding carriage. You'll find the No. 18 in the pattern shops of leading engineering works. Write for Bulletin No. 18.

"Oliver" makes an extensive line of lathes and other woodworking machinery for pattern shops

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NEW PRODUCTS

(Continued from page 81)

FOR FURTHER INFORMATION ON NEW FOUNDRY PRODUCTS LISTED HERE USE CONVENIENT POSTCARD ON PAGE 81.

Micro Particle Classifier

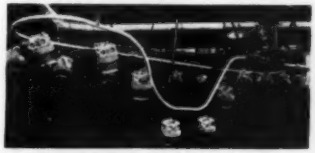
37—Particles below 60 microns can be separated accurately with the Dietert Detroit Micro Particle Classifier, which separates mixed particles into eight fractions from 0 to 60 microns, plus oversize residue, in two hours. Classifier may be applied to such materials as chemicals, dusts, powders, etc., and sample may be as small as 10 grams. Gentle air sorting preserves individual particle size while making sharp divisions in grading. *Harry W. Dietert Co.*

Indicating Pyrometer

38—Compact indicating pyrometer, Model 192, is applicable to either flush or surface mounting and is designed for applications where size of heating equipment is a factor. High-resistance edgewise movement with Alnico V magnet and wide-open mirrored scale is fully compensated and enclosed in dust proof housing. *Wheelco Instruments Company.*

Chain Conveyor

39—Light-capacity, power-driven overhead chain conveyor, the Chain-Veyor, costs approximately half as much as conventional conveyors. Complicated, fast-



wearing parts have been eliminated, and short radius curves and track sections are easily combined so that changes or additions can be made quickly. Chain-Veyor will handle loads up to 30 lb on each pendant, spaced at 6-in. intervals, or 60-lb loads can be carried at 12-in. intervals when supported by two pendants fitted with cross bar attachments. Conveyor

For...

CLEANER CASTINGS
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Foundries using AlSiMag Strainer Cores report substantial reductions in rejects and a major improvement in the smoothness and uniformity of castings.

AlSiMag Ceramic Strainer Cores are flat, hard, kiln-fired ceramic cores that fit snugly into the gate of the mold. They strain the incoming metal and regulate its flow in the best way yet developed.

These cores have excellent qualities for fast handling and easy storing. They are tough, gas free and require no change in molding procedure. They withstand all normal foundry pouring temperatures. They do not disintegrate. They are available in many shapes and sizes, or specially made to your own specifications.

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Test these cores in your own foundry. Samples of sizes in stock sent free on request. Samples made to your specifications; reasonable cost.

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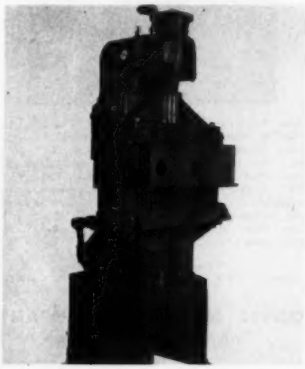
speed is instantly adjustable from 3 to 9 fpm during operation. Higher or lower speed ranges are available on order at no extra cost. Any combinations of turns are possible by joining horizontal, vertical top and vertical bottom curves together. *Southern Engineering Co., Inc.*

Core Rod Straightener

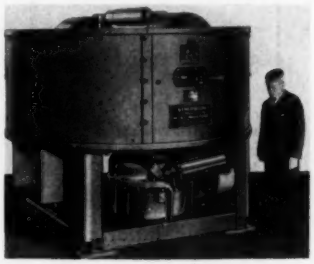
40—Air-operated, high-speed core rod straightening machine has core rod capacity of ¼ to ½ in., with straightening V-block die surface of 24 in., right to left. Machine, claimed by manufacturer to speed production as much as 60 per cent, is designed for foundries producing radiator and cylinder castings, where several



core rods are used in each casting and may bend when extracted from the finished casting. Machine can be furnished with or without automatic unloading device. *General Riveters, Inc.*

Sand Mixer and Muller

41—Utilizing a new concept of sand preparation, Models 2F and 3F Simpson intensive Mix-Mullers make possible increased muller pressures with a minimum of muller inertia. Features include: spring

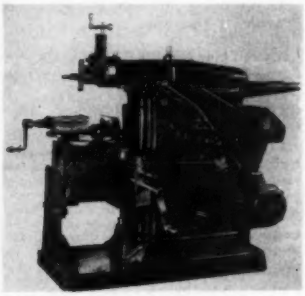


adjusted mullers to provide correct pressure for sand being conditioned; large batch capacity—4000 lb for 3F, and 2000 lb for 2F; less hp—60-75 for Model 3F, 25-30 for 2F; simple V-belt drive for maximum flexibility; large sand output (2 min cycle)—Model 3F 60 T/hr, Model 2F, 30 T/hr. This improved muller design has been thoroughly tested in more than 300 installations throughout the country, many

of which have been operating for three years. *National Engineering Co.*

High-Speed Shaping Machine

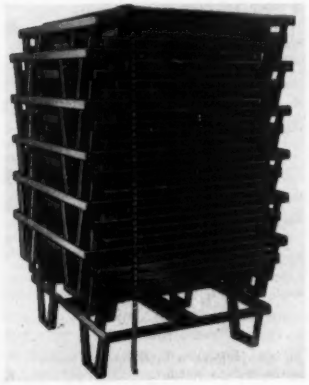
42—Low cost, high-speed floor model shaping machine has an 18-in. stroke and 35-in. ram, and four speeds varying from 22 to 115 strokes per min. Automatic horizontal feed motion is arranged to give four variations of feed per ram stroke. Drive is from self-contained motor mounted on adjustable stool and is transmitted by three V belts through a multiple disk friction clutch to a totally enclosed



four-speed box. Bull gear has helical teeth to prevent chatter. All gears are oil-immersed. Specifications: table surface—16¼ x 11 in.; maximum ram to table—16 in.; longitudinal traverse—16 in.; vertical traverse—14 in.; maximum down feed of tool head—5 in.; vise jaws—8 in.; jaws open—9 in.; base plate size—49 x 21¼ in.; weight—200 lb. *British Industries Corp.*

Nesting Skids

43—Nesting skids of new design are of all-steel welded construction and are adaptable to all types of hydraulic and electric floor trucks. Thirty skids easily nest in a small area, occupy a total height



of only 5 ft from floor level to top of stack. Skids are light enough for easy handling by one man. Skids are available in standard models, as well as in specially designed units to meet individual requirements. *Bloom Systems, Inc.*

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Smelting & Refining Division
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BUFFALO 17, NEW YORK

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A. F. S. Employment Service

To contact "Help Wanted" or "Position Wanted" advertisers, write to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, designating item number and issue of AMERICAN FOUNDRYMAN in which advertisement is published.

Applicants for jobs must send an outline of their experience and background for transmittal to prospective employers.

HELP WANTED

HW569—Foundry Superintendent: for shop producing 500 tons carbon and alloy steel, 300 tons electric iron and 150 tons brass pressure vessel castings per month. Must have broad and extensive experience in foundry operations, proven administrative ability and good practical and technical background. Excellent opportunity with long-established company of best reputation. Reply in confidence giving full information as to age, background and experience as well as salary requirements.

HW573—Foundryman: One of the nation's leading research organizations urgently needs an experienced, top-level foundryman for consulting work with small foundries in India. He must know entire operation of small foundries—sand, molding, melting, labor training, and management. One year assignment; carries excellent salary plus all expenses. He will work as part of a high-level research team.

HW574—Foundry Superintendent: for large uminum sand foundry in the Middle West. ust be experienced in foundry operations.

HW575—Metallurgist for U. S. Naval Shipyard on Atlantic Seaboard. Must be capable of conducting x-ray, gamma ray, Magnaflux and Zyglo examinations of castings, weldments and forgings to determine suitability for Navy use. Applicant must possess B.S. in metallurgy or metallurgical engineering and have 6 months professional experience, or have an M.S. in metallurgy or metallurgical engineering. In reply state full background and experience.

POSITIONS WANTED

PW163—Junior Metallurgist: Graduate metallurgist. Age 28. Now employed as laboratory metallurgist for large automotive foundry. Must settle in Southwest or Mexico for reasons of health. Previous foundry experience includes four-year apprenticeship as journeyman molder and coremaker. Familiar with all phases of brass, gray iron and steel jobbing and production work. Complete resume available on request.

PW164—Selling Sales Manager (Gray Iron): Experienced volume producer desires to contact foundry principals interested in strengthening present sales organization, or taking over and building new. Can originate new business while building friendly relations with present customers. Active buying contacts cover major Midwestern organizations in industrial, farm implement and automotive fields. Salary and bonus based on performance. Available upon short notice.

PW165—Foundry Superintendent: Age 49. 32 years' experience, 16 years as superintendent. Familiar with all phases of gray iron foundry, cupola practice, core room, cleaning and shipping departments and sand control. Some experience in bronze and aluminum. Have supervised loose jobbing and machine high production in light, medium and heavy castings. Can produce alloy high strength iron. Have had good labor relations and can train men in every department.

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1 CUPOLA—SHELL DIAMETER 72 IN.
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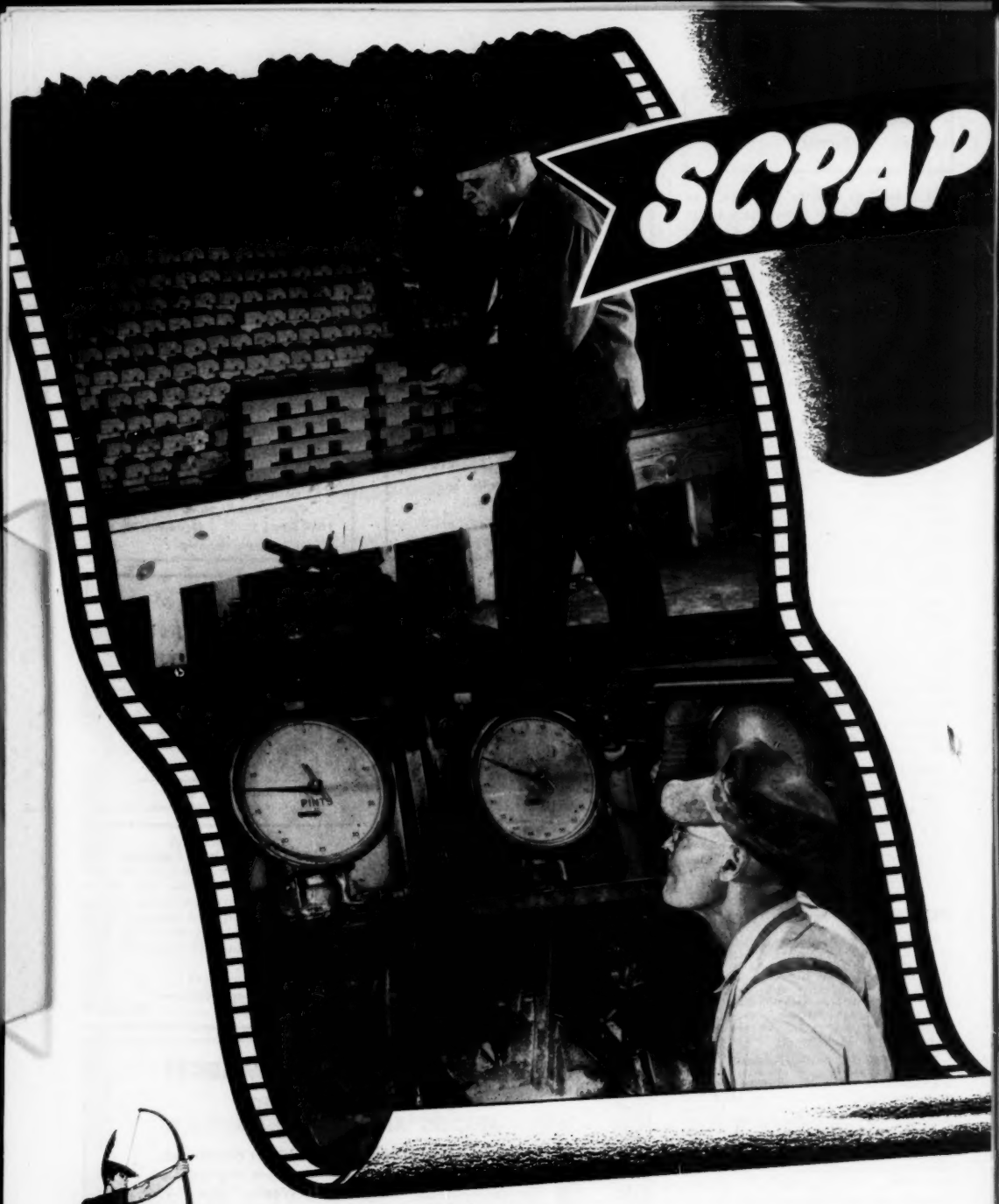

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Foundry Products Division

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"THE ADM OF CORES"

A clear factual movie discussing the problems common to all core rooms.

INTERESTING • INFORMATIVE • EDUCATIONAL

A 16mm motion picture—in full color with sound—originated by foundrymen and filmed in some of today's top foundries.

"The ADM of CORES" is a picture about any foundry's cores; the materials they are made from, the steps in their manufacture. Actually, "The ADM of Cores" is a story of core room control. Showing the careful control of the laboratory, it demonstrates how this supervision can be applied out on the core room floor . . . how the many variables that cause core failure can be eliminated.

Visual explanations of the whys and wherefores of core work are clearly pictured. What happens when too much or too little core binder is used...why different sands give exactly opposite effects in a core mixture. These and other common core problems are discussed in the interest of creating a better understanding of basic sand and core binder characteristics.

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Prints are now available for any foundry meeting, supervisory gatherings, technical association or clinic.

Every Foundryman should see this film—from the boss right down to the sweeper. Arrange now for an early presentation to your group. Prints are available for free showing at technical or trade schools as well.

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Write giving full information, organization, number of people, location and date you have selected. A *Linoil Man* will show it for you, or assist you in making arrangements.

Improve Cupola Charging!

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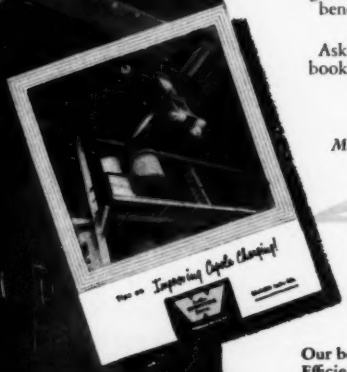

THIS WHITING BOOKLET WILL HELP YOU!

Our booklet FO-1, "How To Make Your Cupola Operation More Efficient" also gives important information. Ask for it, too!

WHITING